A77 Comparison of Methods to Collect Contact DNA From Fabrics

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After attending this presentation, attendees will learn about the different collection techniques utilized and preferred in acquiring contact DNA evidence from fabric items.

This presentation will impact the forensic science community by increasing knowledge about optimization of different collection methods for use on fabric based evidence. This improvement will assist investigators in choosing a collection technique that best fits the evidence in question and the background of the case. In particular, for clothing or other fabric based items that may have come into contact with multiple individuals, the methods described may improve the chances of identifying the victim or the perpetrator of a crime.

The tremendous sensitivity of current forensic techniques makes it possible, but not certain, to obtain a DNA profile from a small number of cells, including those collected from items that have come into contact with one or more individuals. Given this, it is important to collect as many cells as possible, and hence as much DNA, from the item in order to increase the chance of making an identification. Limited comparative research has been conducted on the common techniques used in forensic laboratories to collect DNA from fabric evidence, some of which may be suboptimal—failing to collect the maximum amount of DNA or cells present. Further, in the case of fabric items that may harbor DNA from more than one source, certain collection methods might be advantageous in helping to avoid retrieving mixed DNA samples while still recovering as much DNA as possible.

Common crime laboratory methods for collecting DNA from fabrics include swabbing, tape-lifts, or cutting out an area likely to have come into contact with an individual. The general effectiveness of swabbing has been studied in some detail, usually examining the type of swab used and how best to apply it to a surface. Direct comparisons of tape-lifts and swabs have been made, but generally only utilized saliva as the DNA source. Finally, objective comparison of either swabbing or tape-lifts to cuttings has not been conducted, even though forensic scientists often use the latter technique.

In this study, the three standard methods for collecting contact DNA from clothing were compared. Volunteers wore items such as t-shirts for a prescribed amount of time, and contact DNA was collected from selected areas of the item (e.g., collar or shoulder seams) using swabbing, tape-lifts, or cuttings. Next, separately swabbing or tape lifting the inside and outside of clothing was compared to see if DNA yields varied substantially. Finally, the t-shirts were purposely contacted by more than one volunteer to simulate evidentiary samples that may contain mixed DNA; for example, the inside and outside of a shirt where the arm/sleeve of the wearer had been grabbed. For comparative DNA isolation effectiveness, equally sized segments of fabric were tested using cotton swabs wetted with digestion buffer (containing 0.1% SDS) and rolled over an area of the fabric, tape-lifts applied until the tape was saturated with fabric and/or no longer adhered, or cuttings placed directly into digestion buffer. A standard organic extraction was used to purify the DNA, and yields were quantified using real time PCR, followed by STR analysis.

In general, significantly more cells/DNA were retrieved via cutting and soaking the fabrics than from swabbing or tape-lifts, although the cutting and soaking method tended to result in additional mixed profiles. More DNA was obtained when swabbing the inside versus the outside of the fabric, while there was no difference in DNA yields when tape-lifts were taken from inside or outside of the item. In spite of this, the frequency of mixtures between swabs and tape lifts was similar. All STR profiles generated from fabric samples that contained 200 pg/ml or more of DNA (optimal DNA input) resulted in callable alleles at least 13 loci. Over 80% of the samples that produced 100 pg/ml or more of DNA showed allelic activity at each locus, although approximately 60% of those contained alleles foreign to the wearer (one or more loci with three alleles). Close to 80% of the samples that contained 30 pg/ml or more of DNA (minimum input of 135 pg of DNA) had allelic activity at each locus, but approximately 50% contained alleles foreign to the wearer. Finally, samples with less that 30 pg/ml provided little information, with few or no loci containing callable alleles. The results indicate that although increased DNA yield enhances allelic activity, it may hinder the ability to identify individuals owing to the presence of additional alleles in the STR profile. Considering the totality of the results, careful consideration needs to taken when deciding on a method for cell retrieval from fabric based items.

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