A18 Testing a Combined Approach for DNA and Trace Evidence Recovery Using Tape Lifting on Forensically Important Substrates

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After attending this presentation, attendees will have been introduced to a novel approach for recovering DNA and various types of trace evidence from forensic samples, specifically, a common technique called tape lifting, to collect both trace evidence and "touch" DNA across multiple substrates using modern, automated methods of forensic analysis.

This presentation will impact the forensic science community by promoting a comprehensive approach to technique evaluation, expanding awareness to other instances of discipline overlap, and exploring the effects of other methods on common trace practices. A single type of tape that is optimal for trace evidence and touch DNA collection would streamline training, further interdisciplinary cooperation, and promote synergy during evidence routing and analysis in the forensic science laboratory.

The goal of this study is to test differences in recovery efficiency for trace evidence touch DNA across six types of tape currently in use or being considered for use in the Ventura County Sheriff's Office Bureau of Forensic Services: Evercare™ Lint Pic-Up roller, 3M Scotch™ Lint Roller, HP-260 Duck™ Brand Packing Tape, Lyn-Peavey™ Fingerprinting Tape, Allene's® Tacky Double-Stick Sheets, and Staples® Stickies™ Adhesive Notes. All tapes were tested for the presence of (PCR) inhibitors based on the quality of their internal PCR controls after quantification and the appearance of their electropherograms after amplification. The inhibition study was performed with xylene-treated swabs, water-treated swabs, and with no swabbing of the tape. DNA was provided by spotting 10 µl of 1:200 diluted whole blood from a single source onto the tape to give 3ng of DNA. The ability to recover touch DNA was determined by comparing the average quantifiable DNA from each tape to the average DNA from three, co-extracted reference swabs after tape lifting dried saliva stains from tight weave, knit, and glass substrates. Saliva stains were produced by pipetting 15µl of a 1:30 dilution of whole saliva onto the substrate to give 15ng of DNA. Finally, trace evidence recovery for each tape sample was examined by comparing tape lifting efficiencies of glass fragments, four-layer house paint chips, 100% polyester clothing fibers, and 100% nylon carpet fibers, which had all been rendered to 0.5mm as well as whole pubic hairs and 100% nylon carpet fibers from the same three substrates. Quantitation of touch DNA was carried out using a sequence detection system with an amplification kit and amplified with an amplification kit and an genetic analyzer capillary electrophoresis instrument. Trace evidence identity was established with FT-IR using a single-bounce attenuated total reflectance accessory.

All tape samples produced fully amplified and interpretable profiles across all Combined DNA Index System (CODIS) loci with little to no PCR inhibition, regardless of the pre-extraction treatment. The Duck® Brand HP260 High Performance Packaging Tape recovered the highest amounts of trace evidence and touch DNA across all three examined substrates. While the packaging tape was transparent and easy to analyze, it also picked up much of the background material present in or on the substrate and was somewhat difficult to use compared to the other tapes. The 3M Scotch™ Lint Roller was consistently the second best tape when recovering every type of trace evidence (except 0.5mm carpet fibers) and touch DNA while being easier to use on bedding and other large surfaces. In spite of its difficulty collecting small nylon carpet fibers, the 3M Scotch™ roller never lagged more than 10% recovery behind the packaging tape. All other tapes performed well in specific circumstances, but had inferior recovery efficiency compared to both the packaging tape and the lint roller across all three substrates. The Duck Brand® packaging tape was suggested as the optimal tape for the Ventura County Sheriff's Office Bureau of Forensic Services while the 3M Scotch™ was advised to be used for large areas or in case the packaging tape was not available.

Tape Lifting, Touch DNA, Trace Evidence

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