B7 Further Evaluation of a Dry Vacuuming Technique for Recovery of DNA From Handwritten Documents

Christian Hopkins, BS, John Jay College of Criminal Justice, New York, NY 10019; Patrick McLaughlin, BS, John Jay College of Criminal Justice, New York, NY ; Mechthild K. Prinz, PhD, John Jay College of Criminal Justice, New York, NY 10019*

Learning Overview: After attending this presentation, attendees will know more about a non-destructive method of vacuum swabbing large surface areas of handwritten notes and will have learned how it affects the workflow for paper evidence.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing validation data on a method that allows the investigator to process paper evidence for DNA prior to latent print and questioned document examination. This will increase success rates and reduce contamination events for DNA recovered from handwritten documents.

In a previous presentation, a non-destructive homemade vacuum method for collecting biological material from handwritten documents was introduced.[1] The method had yielded >70% of useful DNA profiles and did not negatively affect friction ridge detail and indented writing. Based on these results, it should be possible to reverse the current forensic laboratory practice of first processing paper for indented writing, then for latent prints, and only collect DNA as the last step from areas with visible prints. Aside from the risk of contamination and loss of DNA, this workflow has the disadvantage of not including any DNA evidence deposited during the writing process and the writer's hand scraping across the page. The previous work had been performed on standard white copy paper.[1] Prior to casework implementation, the method needed to be tested under different conditions (e.g., on different paper substrates). Accordingly, this small validation study was designed to cover other paper types, such as notebook paper, bank deposit slips, magazine pages, and manila envelopes.

Paper substrates were made DNA free by Ultraviolet (UV) exposure in an Air Science UV-Box™. Male volunteers consenting to be part of the study were asked to write a standard text and deposit left-hand fingerprints on each piece of paper. The same set of eight volunteers was used for all paper types. The writing samples were suspended using adjustable magnetic clamps and then vacuumed using a Carolina® 9-inch glass pipette containing a moistened cotton Puritan® swab with a vacuum hose attached to the narrow end of the pipette. DNA was extracted using a lysis buffer with 5% Chelex®, 10% Tween® 20, and Proteinase K followed by concentrating the extract with DNA Fastflow Millipore® Microcon membrane filter units.[2] All recovered samples were quantified using Quantifiler® Trio and typed with AmpFℓSTR® Identifiler® Plus, both from Thermo Fisher Scientific™ Applied Biosystems®. Fingerprints were developed with 1,2 Indanedione in a petroleum ether zinc chloride solution.

The quantity of recovered DNA varied from donor to donor, but showed a trend that can be explained by the different sizes and surface properties of the tested paper types. Copy and notebook paper had the same size, but copy paper is rougher and yielded more DNA. Deposit slips with their smooth surface and small size had a very low DNA yield. The vacuum did not work well on manila envelopes as these were too thick to allow for air to pass through and the vacuum had less suction. Magazine paper is very thin and was difficult to handle. Fingerprints were successfully detected on copy paper, deposit slips and manila envelopes, but not on magazine paper. Friction ridge detail quality was not affected by the vacuum collection process.

Reference(s):

1. McLaughlin P., Prinz M. Improved DNA recovery from handwritten documents. *Proceedings of the American Academy of Forensic Sciences*, 71st Annual Scientific Meeting, Baltimore, MD. 2019. Abstract B114, p318.
2. Forsberg C., Jansson L., Ansell R., Hedman J. High-throughput DNA extraction of forensic adhesive tapes. *Forensic Sci Int Genet.* 2016; 24:158–63.

DNA Recovery, Paper, Fingerprints

*Presenting Author