E22 An Evaluation of Various Swab Types for Recovery of Touch DNA From Firearms

Raven DeWeese, BS, Glenside, PA 19038-3930; Catherine O. Brown, MSFS, Center for Forensic Science Research & Education, Willow Grove, PA 19090; Thomas V. Walsh, MSFS, NMS Labs, Willow Grove, PA 19090; Heather L. Harris, JD, Glenside, PA 19038; Megan M. Foley, MSFS, Center for Forensic Science Research & Education, Willow Grove, PA 19090*

Learning Overview: After attending this presentation, attendees will have a better understanding of how new commercial products for the collection of touch DNA compare to traditional swab types for recovery of genetic material from firearms evidence.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by evaluating both the adsorption and initial collection capabilities of the various swab types as well as the release and, thus, overall recovery of DNA based not only on swab substrate but shape, informing the practitioner community as to which swab types are best suited for the recovery of DNA from handled firearms evidence.

Amidst efforts to reduce illegal firearms and gun violence, laboratories have seen increased submissions of firearm-related evidence for genetic testing. Obtaining quality DNA profiles by following optimized protocols is instrumental in assisting with these criminal investigations. Published literature has established that the substrate of a swab (cotton, foam, nylon flocked, polyester, rayon, etc.) affects adsorption capacity and even DNA release, but more recent product designs have focused on the overall shape of the swab head to further enhance collection and concentrate touch DNA from challenging sample types, such as firearms. Currently, DNA collection from firearms is most often performed utilizing cotton- or nylon-flocked swabs that have rounded tips. Cotton swabs have an absorbent core that will draw samples to the center and potentially trap them. Nylon-flocked swabs have been developed to increase the amount of DNA released from swabs by having no internal absorbent core, keeping the sample on the surface for quick release.

This project focused on evaluating recently developed products by Gentueri, which include: SimpleSwab™, SimpleSwab2™, SimpleSwab3™, and SimpleSwab4™ that vary in material thickness and shape of the swab head. The efficacy of these new products will be compared to two commonly used swabs, including: general round cotton-tipped swabs and nylon 4N6FLOQSwabs™. Both the collection and recovery efficiencies of these swabs were evaluated. First, release of DNA from each swab was determined for a direct comparison between all swab types. Known concentrations of DNA were placed directly onto swabs to evaluate release and then again on a substrate and collected with each swab type to evaluate recovery and release combined. Each swab type was then used for the recovery of touch DNA from a firearm to simulate real casework samples. A double-swab technique was utilized for collection of touch DNA from four locations on each firearm, including the trigger/trigger guard, slide serrations, grip, and the magazine. Each sample will be separated into two halves and treated as two samples to determine variability among one swab. The swabs will undergo an organic extraction followed by quantification using Quantifiler® Trio, amplification using PowerPlex® Fusion 6C, separation on an ABI® 3500 Genetic Analyzer, and analysis using GeneMapper® IDX software.

A one-way Analysis Of Variance (ANOVA) statistic was performed for a quantitative comparison using resulting DNA concentration values. No significant difference was observed in DNA release from swab types tested with 125 picogram (pg) and 500pg total DNA [$F(5)=3.11$, $p=0.63$ and 0.36, respectively]. Further work to evaluate additional DNA concentrations is currently in progress. Through quantitative and qualitative analysis of the DNA recovered, the optimum swab type/shape for the recovery and release of touch DNA from firearms evidence was determined. With the completion of this project, valuable information regarding the ability to increase genetic profile strength from front-end sampling of touch DNA will be disseminated.

Firearms, Touch DNA, DNA Collection and Recovery