G52 Cotton Swabs vs. 4N6 FLOQSwabs™: A Comparative Study for Optimal Recovery of Touch DNA

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After attending this presentation, atattendees will have a better understanding of how touch DNA recovery could vary between different collection swabs, swabbing techniques, and extraction processes, and how different surfaces affect touch DNA recovery with two different types of swabs: 4N6 FLOQSwabs™ and cotton swabs.

This presentation will impact the forensic science community by discussing the comparison of the 4N6 FLOQSwabs™ and standard cotton swabs used in crime labs in their ability to recover touch DNA from various surfaces as well as the comparison of their ability to preserve touch DNA in the presence of common environmental contaminants.

Over the last few years, the boost in sensitivity and robustness of forensic STR kits has increasingly made touch evidence a potential source of DNA profiles that can become useful to an investigation. Thus, the ability to properly collect and handle touch DNA plays an important role in this process, given the small amount of genetic material left behind from handling an object, mostly from epithelial cells. Standard practice in many laboratories is the use of moistened cotton swabs to swipe the surface allegedly touched by the suspect. These swabs are made of cotton fibers wrapped around the tip of a ~ 6" stick. Although highly absorbent, this type of swab has an inside core that can trap cellular materials within its fibers. The 4N6 FLOQSwabs™ are instead made by applying glue to the tip of an applicator and perpendicularly spraying onto this surface tens of thousands of short nylon strands. Liquid absorption is obtained by capillary action induced by the surface tension between the nylon strands. Furthermore, 4N6 FLOQSwabs™ lack an inside core to trap cellular materials.

For the purpose of this study, a common sterile, DNAase/RNAase-free cotton swab was compared to the 4N6 FLOQSwabs™ manufactured by Copan Italia specifically for forensic applications. The FLOQSwabs™ are produced in a controlled human-free environment and are certified human DNA, DNAase and RNAase-free, are treated with an antimicrobial reagent, and undergo ethylene oxide sterilization; they have a breaking point right above the swab tip to facilitate the transfer of the swab inside the Nucleic Acid Optimizer (NAO™).

Touch DNA evidence was simulated by having volunteers handle specific objects for one minute (glass, wood, and leather). The handled objects were divided into quadrants and swabbed with the two different types of swabs in duplicate. Multiple experiments were performed and different combinations were tested: multiple individuals, different swabbing techniques (wet vs. dry), and the use of a NAO™—a basket with a semi-permeable membrane) that is used during extraction. The experiments were designed in order to standardize conditions as much as possible and ensure that the amount of cells on the various quadrants were similar; nevertheless, the amount of cells that are shed by an individual is somewhat unpredictable. Thus, to determine the actual percentage of DNA recovery, known amounts of DNA were spotted onto glass slides and allowed to dry. Slides were then swabbed with the two different types of swabs and subjected to extraction (DNA is basically being re-extracted). Due to the expected loss of DNA during the re-extraction process, results were normalized against the same amount of DNA re-extracted directly from the tube.

Results show that, on average, 4N6 FLOQSwabs™ yielded greater amounts of DNA than the cotton swabs, particularly when sample collection was performed with the moistened swab and extraction was conducted with the aid of the NAO™. This presentation will also discuss how the antimicrobial treatment protects the DNA from bacterial degradation after sample collection.

Touch DNA, Cotton Swab, Flocked Swab

 ** Presenting Author*