A59 The Persistence of Foreign DNA Under Fingernails

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After attending this presentation, attendees will have a better understanding of the background levels of foreign DNA that may be present under fingernails and the impact it has on the evidentiary value of DNA collected from fingernail debris. They will also learn of the collection technique that is most efficient for isolating foreign DNA that may be present under the nail.

This presentation will impact the forensic community by examining the background levels of exogenous DNA present under an individual's fingernails, and how it may be important in clarifying the value of DNA evidence recovered from fingernail debris. Comparing different techniques used to collect fingernail evidence will make it possible to implement the technique that produces the most complete profiles from exogenous DNA while minimizing the endogenous DNA profile into evidence collection performed by investigators, sexual assault nurse examiners, and pathologists.

In January 2005, a Michigan college professor was murdered; foreign DNA found under her fingernails did not match the primary suspect, who was later convicted of criminal sexual conduct and murder. A confession by another individual and further investigation resulted in the initial conviction being overturned. This lead to the question, how common is it for foreign DNA to be present under an individual's fingernails?

Throughout an investigation, police seek to connect a suspect to the scene or the victim through evidence or witness statements. DNA analysis of debris collected from under a suspect or victim's fingernails has been used to link a suspect to a victim as the fingernail provides an isolated and somewhat protected area for DNA-containing cells to accumulate (Cook and Dixon, 2007). In a violent struggle, as might occur during a sexual assault or murder, the victim may attempt to defend themselves against their attacker. During this process, the victim's nails may come into contact with the perpetrator, allowing for the transfer of biological material between the victim and suspect.

In contrast, activities such rubbing the face or eyes, scratching, or biting fingernails may increase the concentration of the donor's own cells under the nails. If foreign DNA is present, these activities will cause a mixture to be observed, increasing the difficulty of interpreting the resulting DNA profiles. Swabbing and scraping are techniques often employed for the collection of fingernail evidence, although these have not been optimized to alleviate the problem of mixtures. Cline *et. al.* (2003) developed a type of differential extraction to isolate the exogenous DNA found on a nail from the endogenous DNA found in the nail. The technique involved soaking nail clippings in a solution that effectively isolated the exogenous DNA that was present while leaving the nail intact. The DNA in solution could then be carried through the analysis process. Since the nail remains undisturbed, the likelihood of detecting a mixture due to the degradation of the nail itself is minimized.

Prior contact between a victim and suspect is sometimes used to explain the presence of the suspect's DNA under a victim's fingernails. However, Cook and Dixon (2007) swabbed nails from 100 individuals and examined them for mixtures. It was demonstrated that only a small amount of exogenous DNA was found under the fingernails and the only significant ($p < 0.05$) results for mixture profiles were obtained from males who had been in physical contact with another individual in the 24 hours prior to sample collection. This indicates that when a strong mixed profile is observed from a fingernail sample it is not likely due to previous casual contact between the victim and the suspect.

The goal of the current research was to compare different techniques, specifically cutting, scraping, and swabbing, to determine which is the most effective at obtaining foreign DNA that may be present under a nail while limiting the risk of contamination from the nail itself. A second goal was to clarify the evidential value of fingernail evidence by examining the background levels of foreign DNA under an individual's fingernails.

Study participants were asked to superficially scratch another participant and different techniques were utilized to collect any cells under the nails. Further, the undersides of fingernails of random individuals were swabbed. DNA extractions were performed, followed by STR analysis and comparison to control (buccal) profiles. The various techniques tested showed differences in their ability to limit the amount of nail DNA carried through the analysis. Also, a relatively small percentage of individuals carried foreign DNA under their nails if they had not been in purposeful physical contact with another person.

DNA, Fingernails, Swabbing

 ** Presenting Author*