B124 An Examination of the Persistence of Indirectly Transferred DNA on Regularly Used Knives in a Stabbing Simulation

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Learning Overview: After attending this presentation, attendees will have a better understanding of ways in which indirectly transferred DNA can potentially complicate the interpretation of relationships between DNA evidence and criminal acts. This presentation will: (1) demonstrate the persistence of transfer DNA on objects that have both important daily functions and potential evidentiary importance over the time-period of one week, and, (2) demonstrate the detection of both directly and indirectly transferred DNA on these objects over time.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a systematic investigation of transfer DNA persistence and the ways in which indirectly transferred DNA can complicate interpretations between DNA profile data and direct contact with evidentiary items. Advancements in DNA typing technologies have allowed for the generation of DNA profiles from smaller quantities of template DNA. As a result, the likelihood of amplifying DNA that has been transferred indirectly to an object has greatly increased. There are many variables that can affect the transfer and subsequent detection of DNA on inanimate objects.

This study expands upon previous research conducted by Meakin and colleagues that examined the persistence of secondary transfer DNA on inanimate objects.[1] In the current study, 12 participants were instructed to handle a knife for approximately one minute, twice a day, for two days to simulate regular daily use of an object. On the third day, the participants were instructed to shake hands with another participant for 10 seconds, pick up the knife and then stab the knife into a Styrofoam bowl repeatedly. Each knife was swabbed one hour and one week after the simulated stabbing event. DNA was purified from the swabs using the QIAGEN QIAamp DNA minikit, amplified using the GlobalFiler™ Polymerase Chain Reaction (PCR) Amplification Kit and analyzed on an Applied Biosystems® 3130xl genetic analyzer. The data was interpreted utilizing the Mixture Analysis Tool within GeneMapper® ID-X version 1.5. The DNA profiles identified were examined to address the following null hypotheses: (1) transfer DNA consistent with the handler will not be detected on knives sampled one hour after contact. (2) transfer DNA consistent with the handler will not be detected on knives sampled one week after contact. (3) a mixed DNA profile will not be detected in the samples collected one hour after handling. and (4) a mixed DNA profile will not be detected in the samples collected one week after handling.

DNA was detected on 91% of the knives sampled one hour and one week after handling. DNA mixtures consistent with the DNA profiles of both the knife handler and the person they touched were detected in most samples. Of the samples collected one hour after the stabbing event, 70% produced mixed DNA profiles. Of the samples collected one week after the stabbing event, 90% produced mixed DNA profiles. Additionally, extraneous DNA that could not be attributed to either participant in the pairing was detected in over half of the total samples, demonstrating the complex nature of DNA transfer.

The results of this study illustrate the potential issues and complexities regarding the interpretation of transfer DNA on regularly handled inanimate objects. In this study, DNA transferred by both direct and indirect means were detected on the objects examined. Additionally, only 10 seconds of contact between participant pairs was sufficient to indirectly transfer DNA from person to object via an intermediary individual. Therefore, this study illustrates the complex nature of DNA transfer and the difficulty in predicting the mode of DNA transfer (direct or indirect) based on the DNA profile identified on an object.

Reference(s):

1. Georgina E. Meakin, Emma V. Butcher, Roland A.H. van Oorschot, and Ruth M. Morgan. "The deposition and persistence of indirectly-transferred DNA on regularly-used knives." *Forensic Science International: Genetics Supplement Series* 5 (2015): e498-e500.

Transfer DNA, DNA Persistence, DNA Mixtures