A29 The Ability to Obtain Full DNA Profiles From Nail Clippings After Long-Term Storage at Room Temperature Could Impact the Process of Human Identification

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Learning Overview: After attending this presentation, attendees will better understand how nail material obtained from both living and deceased individuals can provide informative DNA profiles following storage at room temperature.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by contributing to a growing body of knowledge regarding the use of alternative and often neglected sources of DNA profiles utilized for positive personal identification.

Saliva and blood are commonly used in the medicolegal system to produce DNA profiles; however, these bodily fluids are no longer an option for decomposed or skeletonized human remains and must be stored in a refrigerator or freezer until the DNA purification process can take place. Bone can be utilized as a source of DNA without cold storage but, depending on the size of the skeletal element being held, can require a great deal of secure storage space. Additionally, the DNA extraction and purification processes destroy the hard tissue of the bone, which may be needed for subsequent forensic anthropological analysis. Nail clippings, if present, can serve as the source of a DNA profile when soft tissues are not present and when the bone is needed for additional forensic analysis.

Toenails collected from six deceased and ten living individuals were used to test the following null hypotheses: (1) H_n1—there is no relationship between DNA quantity from human nails and time stored; (2) H_n2—there is no relationship between DNA quality from human nails and time stored; and (3) H_n3—there is no difference in DNA quantity and quality between nails taken from living and deceased individuals.

DNA was extracted from the nails using the QIAGEN® QIAamp® DNA Mini Kit with modifications to the manufacturer's instructions to allow for an extended dissolution process. The samples were quantified using Quantifiler® Trio on an Applied Biosystems® 7500 Real-Time PCR System, amplified with the GlobalFiler™ PCR Amplification Kit, and analyzed on an AB SCIEX™ 3130xl genetic analyzer. The nails collected from living individuals were sampled for extraction three times during the two-year time period: after 1 month, 14 months, and 24 months of storage. The nails collected from deceased individuals were sampled for extraction at the beginning and end of ten months of storage.

This study failed to reject all three null hypotheses. Although the means for DNA quantity decrease over time, repeated measures of Analysis of Variance (ANOVA) indicates that these decreases are not statistically significant for either living or deceased individuals. All samples obtained from both groups produced full, single-source DNA profiles at each time of analysis. The samples obtained from living individuals were compared to reference profiles obtained from buccal swabs. All profiles remained consistent with the references at each time of analysis. Thus, there was no recognizable relationship between DNA quality and time stored. There was not a statistically significant difference ($p<0.05$) between the quantity of DNA obtained from the nails of living or deceased individuals. All samples produced full DNA profiles at each time variable. Therefore, there is no significant difference between the ability to generate a full DNA profile from nails taken from living versus deceased individuals.

These results indicate that nail clippings can be utilized for DNA analysis and serve as a viable alternative to more readily used tissues, such as blood and bone. However, the sample sizes were small, so this study should be considered a pilot study only. The use of these keratinized cells for genetic analyses could impact the way biological material is archived for identification purposes by: (1) reducing the need for cold storage, (2) decreasing the amount of necessary secure storage space, and (3) preserving the skeletal material for forensic anthropological analyses.

DNA Analysis, DNA Identification, Toenail Clippings