A52 Improved Isolation of DNA From Forensic Dental Specimens

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After attending this presentation, attendees will learn a different less destructive technique to obtain DNA from from forensic dental specimens versus the more traditional crush and grind method of obtaining DNA from the pulp.

This presentation will impact the forensic science community by giving forensic biologists and those that also work on mass disasters, a technique of obtaining DNA from a dental specimen while preserving it for possible return to family members especially if it is the only sample that remains from an individual.

The DNA Missing Persons Unit within the Department of Forensic Biology at the New York City Office of Chief Medical Examiner performs nuclear and mitochondrial DNA testing for the purposes of identification, re-association of body parts, and upload into the Combined DNA Index System (CODIS). While success rates for postmortem samples such as blood, tissue, and bone were as expected, dental specimens failed to give consistent results. This may have been caused by exposure to detrimental environmental conditions. These environments may vary from bodies found in water, to remains buried in soil, or encased in cement. The goals of this study are to evaluate how exposure to the following conditions - water, soil, and cement - affects the ability to extract nuclear DNA from dental samples and to determine what improvements can be made to the examination and extraction protocols.

One hundred-twenty (120) adult teeth collected as dental waste from private dental offices were examined and categorized by a dentist according to tooth type (molars, incisors, premolars, and canines) and any abnormalities such as dental caries (cavities), open apices, calcification, and discoloration were noted. The teeth were incubated in soil, cement, and water from the East River in New York City, or physiological saline from 1 to 48 weeks. Two specimens from each environmental condition had the pulp tissue extracted at weeks one, two, three and four and every four weeks thereafter using a dental pulpectomy procedure. The pulpectomy involved removing tissue from the pulp chambers using nerve broaches utilized by dentists when performing a root canal. A phenol:chloroform:isoamyl alcohol (PCIA) extraction was performed on the pulp tissue. Each DNA sample was quantified, amplified with the Applied Biosystems (ABI) Identifiler[a] kit (28 cycles), and alleles detected using the ABI PRISM 3130xl Genetic Analyzer.

The current method used to extract DNA from teeth involved grinding the entire tooth using a freezer mill. This destroyed the morphology of the tooth and successful DNA results fluctuated and were unpredictable. Results from this study greatly improved examination procedures; the morphology of the tooth structure was maintained while examination efficiency increased by accessing the DNA in the tooth through pulpectomies.

By week 40, 30.8% generated full profiles and 16.7% generated high partial profiles all eligible for entry into CODIS. Overall by week 40, the number of identified loci decreased over time in most conditions but DNA extracted from dental specimens buried in soil showed the strongest reduction in identifiable loci.

Prior caries status of a tooth was not a factor in DNA extraction as those teeth yielded sufficient amounts of DNA. Conversely, teeth with open apices, that were calcified, or had no visible pulp tissue did not yield DNA or yield sufficient amounts of DNA for concentration or amplification.

Overall, the goals of this study thus far have been met. Improvements to the examination of dental specimens through pulpectomies require less examination and hands-on time compared to the conventional freezer mill method. Pulpectomies preserve the morphology of the tooth and yield similar DNA results. The dental specimens exposed to cement, soil, water, and even physiological saline show degradation over time as evidenced by the decrease in DNA concentration and quality of DNA profiles obtained.

DNA, Teeth, Extraction

