B132 The Effects of Water Immersion on the Recovery of DNA From Human Remains

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After attending this presentation, attendees will better understand the effects of short duration (≤1 month) immersion in different types of water on human remains. This study presents data regarding the quantity and quality of DNA recovered from human soft tissue and bone after immersion in fresh, brackish, and salt waters. Data is shown for immersion periods ranging from 24 hours to 1 month in each type of water.

This presentation will impact the forensic science community by demonstrating that the quantity and quality of DNA recovered from different tissues is affected by both the duration of immersion and by the type of water in which the remains are immersed. This data will allow forensic scientists to better predict the success of DNA typing from human remains based on estimated time of immersion and water type, thus assisting in producing the most complete Short Tandem Repeat (STR) profiles possible.

There are numerous incidents that involve human remains in water and, as a result, identification of the individuals from these remains is of great importance. The purpose of this study was to determine if a DNA profile could be retrieved from human bone and soft tissue immersed for varying periods of time. It also assessed the effects of different water types on recovering usable DNA from the tissue samples. Human rib and associated muscle/connective tissue samples were collected from multiple individuals during autopsy. The soft tissue was separated from the bones, which were then equally sectioned, and both were immersed in salt water (~35ppt), brackish water (~10ppt), or fresh water (~0ppt) for intervals of 24 hours, 48 hours, 72 hours, 96 hours, 1 week, and 1 month (31 days). Time-control samples were also used for each of the different intervals, with no immersion in water. A time zero sample for each tissue type was run for each experiment to ascertain the approximate starting quantity and quality of the DNA.

DNA from the bone and soft tissue samples was extracted using QIAamp®, quantified with Quantifiler®, amplified via PowerPlex® 16 HS, and analyzed using standard methods of STR analysis employed in forensic laboratories. The DNA profiles generated were compared to the reference samples to determine how many of the alleles present were concordant with the references. DNA quality in each sample was assessed by averaging the number of heterozygous loci with peak height balances that were ≥70% and by comparing the average peak heights at loci D3S1358 and FGA for each immersion time interval.

Resulting data established that DNA degradation increased as time increased. All samples yielded full STR profiles after 24 hours of immersion with no significant DNA degradation present. After 48 hours of immersion, some samples, particularly bone in salt and brackish water, began to show allele and/or locus drop-out and heterozygous peak height imbalance indicating DNA degradation; however, full profiles were not uncommon at 48 hours. There was a significant reduction in the DNA quantity and quality in all sample types between the 48-hour and 72-hour immersion times. After 72 or more hours of immersion, some samples yielded full profiles, but locus drop-out and heterozygous peak height imbalance were common. While DNA degradation was severe after one month of immersion, typable STR results could still be produced in some samples. The results for soft tissue samples showed that after one month of immersion, samples in salt water had the highest DNA loss but produced the best quality DNA as measured by heterozygous peak height balance as compared to the same immersion time in fresh or brackish waters. After one month of immersion, bone samples in fresh water had the lowest DNA loss and produced the best quality DNA as compared to the same immersion time in salt or brackish waters.

DNA, Human Remains, Water Immersion

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