B28 Effects of Cyanoacrylate Fuming, Time, and Location of Biological Material on the Recovery and Analysis of DNA From Post-Blast Pipe Bomb Fragments

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The educational objectives of this presentation are to demonstrate that DNA analysis can be performed on post-blast pipe bomb fragments; to show how biological material located on pipe bombs is subjected to a unique set of environmental challenges; to convey the effects of cyanoacrylate fuming, if any, on DNA analysis of post-blast pipe bomb fragments; to convey the effects of time between pipe bomb deflagration and collection on the success of the DNA analysis; and to convey the effect of where the biological material is originally located has on the success of the DNA analysis.

This presentation will impact the forensic science community by making the attendees more aware of the factors that affect the success of DNA analysis of post-blast bomb fragments and the practitioners will use this knowledge to the benefit of their laboratories.

As knowledge and technology have improved in the collection, extraction, amplification, and analysis of biological material, the range of evidence potentially suitable for DNA analysis has expanded to include touch evidence. Specifically, with respect to the jurisdiction of the Bureau of Alcohol, Tobacco, Firearms and Explosives Laboratory, it may now be possible to identify the individual who assembled a pipe bomb by analyzing the fragments collected after the device has been deflagrated.

Forensic evidence commonly encountered in the laboratory has been exposed to environmental insults including degradation due to bacterial action, environmental contaminants from the scene, and laboratory introduced chemical contaminants during the course of routine examination. Added to these challenges, biological material recovered from post-blast bomb fragments has been exposed to unique extreme conditions. As the device deflagrates, the biological material is exposed to both extreme temperatures and the products of combustion. These highly oxidative combustion products coat the fragments and can further degrade the DNA over time.

This study investigates the effects of several of these factors. Collection and analysis of the biological material was performed both within days of deflagration and three months later to determine the effect of time. While previous examinations of the effects of cyanoacrylate fuming have been conducted to determine if it has detrimental effects, it was hypothesized that the cyanoacrylate fuming may actually protect the biological material remaining on the fragments over time if the fragments are fumed soon after collection. The study also compared the success rate of DNA analysis on biological material placed on the end cap and that of biological material placed on the pipe nipple.

To perform this study, six pipe bombs were assembled using 1” x 8” steel pipe nipples and associated end caps. The components were cleaned, decontaminated with 10% bleach, and rinsed with 70% ethanol prior to deposition of the biological material. Six aliquots of a washed buccal cell suspension were spotted at marked areas on each of the end caps and each of the pipe nipples and allowed to dry overnight. A buccal cell suspension was used instead of individuals handling the components to ensure a consistent initial quantity of biological material. The devices were placed in the center of a roll of chicken wire and placed in individual trenches to increase the chances of recovering the post-blast fragments. After deflagration, the fragments were recovered and taken to the laboratory. The following day the fragments from three of the devices were cyanoacrylate fumed. The double swab method was used to collect the biological material from two spots on each pipe and two spots from each pair of end caps resulting in four samples from each device and a total of twenty-four samples from all the devices. The remaining fragments were kept at room temperature in the laboratory until the collection and analysis was repeated three months later.

DNA analysis was performed on the swabs at the time of each collection. The tips of each pair of swabs were extracted together using the Qiagen QIAamp® Micro Kit. The concentrations of DNA in the extracts were determined using the ABI Quantifiler™ Human DNA Quantification Kit and the ABI 7500 Real-Time PCR System. STR amplification and analysis was performed using the ABI AmpFLSTR® Identifiler® Amplification Kit and the ABI 3130 Genetic Analyzer with GeneMapper™ ID software.

Four main conclusions were drawn from data collected during the course of this study. First, as has been shown previously, DNA can be recovered and successfully analyzed from post-blast bomb fragments. Second, cyanoacrylate fuming demonstrated no beneficial or detrimental effects on the DNA analysis of the biological material recovered from the fragments either immediately after deflagration or when analyzed three months later. Third, significantly more DNA was recovered from the cell spots on the pipe fragments than from the end cap fragments at both time points. Finally, time between deflagration and sample collection/DNA analysis had a significant effect on the amount of DNA recovered from the post-blast fragments and therefore the chances of successful DNA typing. **DNA Analysis, Pipe Bomb, Post-Blast**

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