A19 Touch DNA Profiling by Means of Single Tube Extraction Method From Cyanoacrylate Fumigated Latent Prints Developed on Weapons, Cartridges, and Casings

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After attending this presentation, attendees will gain knowledge about the potential of a Single Tube DNA extraction method in STR profiling from cyanoacrylate treated prints.

This presentation will impact the forensic science community by showing the application of a combined approach developed to yield useful STR profiles from cyanoacrylate fumigated weapons and cartridges, in real casework investigations, through the set-up and the reporting of the preliminary results of a thorough experimentation, designed to assess the influence of critical factors in DNA profiling, such as the role of surface matter in PCR inhibition, the degree of enhancement reagent inhibition and how to overcome it, the effect of ALS exposure to DNA degradation, and the detrimental effect of the enhancement process in the epithelial cells/nucleic acids release.

Touch DNA normally refers to STR typing from handled objects for personal identification purposes. Routinely, forensic practitioners used to fumigate touched objects with cyanoacrylate in order to enhance latent prints. Superglue fuming is one of the most widely used techniques for the detection of marks. On the other hand, fingerprints are also a well- known source of biological material; indeed, epithelial cells can be transferred as residues from sloughing or through direct contact with an object. Sometimes fingerprint characterization cannot be performed after enhancement because of smudging and/or overlay. For this reason, many authors have attempted nuclear DNA typing from recovered fingerprints for use in criminal investigations. In general this trend has led to the demand for an assessment of technical reliability of DNA analysis performed on exhibits. So far, unambiguous approaches in this field have not been indicated yet, nor has the establishment of reliable and robust guidelines been considered an easy task. Different homicide cases, which included "touch DNA" analysis after cyanoacrilate fuming on handguns, rifles, and various ammunitions, are presented. Following collection by swabbing with bidistilled water, adjusted single tube extraction, traditional STR, and mini-STR analysis methods were performed. In the first case, a profile recovered from a partial print on a handgun trigger revealed that the gun was carried to the crime scene by the victim and used first to threaten the alleged murderer. In the second case, a partial profile was yielded from the bolt handle of a rifle, excluding the match with the suspect's profile. In the third case, partial DNA profiles were obtained from a 12-gauge and from a .32 auto caliber spent casings. An STR allelic pattern from the .32 auto casing was not assigned, but the

DNA profile from the 12-gauge casing matched with a LP Unit technician's profile that accidentally contaminated the item. Even if QA requirements were strictly adhered to, the mishap strengthens the argument for evolution in laboratory procedures. In addition to the investigative potential, the above mentioned results points out the limits and drawbacks of such an approach. Following the results from real casework, the goal was to set up an experimental procedure to assess the influence of various factors affecting the yield of STR profiles. At first, the laboratory's proficiency was assessed by analyzing prints left by unrelated donors on microscope sterile slides. Then DNA analysis was set up on an array of prints left by the same donors on different items including plastic bags, metal boxes, a brand new Beretta handgun, and several brand new 9mm brass fmj cartridges, properly cleaned before print deposition. Each article was separately inspected with a forensic light. Cyanoacrylate fuming was then performed in a DNA free cabinet that was sterilized before and after each single process to avoid cross contamination. After enhancement, each article was inspected and photographed to collect marks. Finally the article was submitted to the DNA lab for analysis. DNA extractions were performed using the following parameters: (1) swab with 3x3 mm paper with bidistilled water; (2) single tube extraction in 30-50 µl final volume and DNA amplification following recommended protocol; and (3) blank control extracted with every sample. PCR was carried out using traditional STR and mini-STR kits and every sample was amplified in duplicate or in triplicate repetition to monitor stochastic fluctuation. Preliminary results indicate a good degree of reliability of the approach when applied on most of the tested items. Previous work showed inhibition caused by cyanoacrylate during the extraction and amplification processes, while more recent articles indicate the use of diverse strategies to overcome such analytical hurdles. As to the latter issue, it should be emphasized that the untreated fingerprints usually provided better STR DNA profiles than the treated fingerprints. In the single tube approach, adequate methodology prevents or minimizes the loss of DNA, whereas inhibition and "in-tube" nucleic acid degradation is still the major concern. As a matter of fact, the single tube approach revealed an enormous potential: a higher sensitivity in touched objects for STR profiling could be reached by properly adjusting the reaction conditions and by using length-reduced amplicon markers. Profiles were obtained both from good and poor quality fingerprints, revealing the independence between good fingerprint

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donors, and good DNA shedders.
Touch DNA, Latent Prints, Superglue

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