D28 Assessment of Portable Forensic Detection Equipment and Methodologies on Biological Evidence From Commonly Encountered Forensic Substrates

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After attending this presentation, attendees will be familiar with multiple forensic detection methods that are portable and applicable for field forensic operation, offering effectiveness at detecting biological samples from commonly encountered forensic substrates, with consideration of the influence of variable lighting conditions.

This presentation will impact the forensic science community by providing an impartial evaluation of current alternate light sources and chemical detection methods for crime scene investigation. Comparisons of portable forensic methods will be demonstrated whilst highlighting the most befitting method tested for each forensic scenario.

The ability to successfully detect individual biological samples from various evidence substrates is the first tier to an efficacious forensic process. To a great extent, this capability depends on the type and amount of biological specimen present, substrate material, and environmental conditions. Typically, the high variability of forensic circumstances requires access to an extensive amount of materials and equipment to adequately investigate all possible scenarios. Therefore, effective and multifaceted tools capable of detecting biological deposits amidst a vast range of conditions are imperative for a thorough and expeditious crime scene investigation.

In this study, seven different portable alternate light sources ranging from wavelengths of 365nm to 530nm were evaluated. Each light source was evaluated by measuring the ability to detect eight different biological contributions (blood, semen, saliva, urine, 1:1000 diluted blood, 1:3000 diluted blood, dry fingerprints, and oily fingerprints) on nine common porous and nonporous substrates. Each biological contribution was deposited onto each substrate in triplicate. During evaluation, three variable light conditions (no light, low light, and bright light) were used to simulate environmental conditions. In addition, 14 commercially available chemical detection methods were evaluated. Each developing agent was evaluated by measuring the ability to detect biological contributions on various substrates. Each chemical method was tested according to the manufacturer's recommendations, which stated biological specificity and additional developing requirements.

Evaluations for each alternate light source and chemical method were performed 24 hours after the biological contributions were deposited. Three scientists independently evaluated the detection of each biological deposit in triplicate for every substrate and lighting condition using a 1-3-9 rating scale. This measurement scale allows for a clear distinction between performing poorly (1), performing marginally (3), and performing well (9). An aggregate of 216 independent evaluations were made for each type of alternate light source using the 1-3-9 rating scale (1,512 total evaluations). Chemical methods were evaluated on biological contributions depending on the manufacturer's recommendations for specificity. Using the 1-3-9 rating scale, 1,044 total evaluations were performed using chemical developers on nine substrates. In addition to evaluating the detection of each biological deposit, the chemical methods were also evaluated on usability. Usability for this study was defined as "the ease of use in a field setting as a portable technique." Similar to the rating scale for detection, usability was rated as poor (1), marginal (3), or excellent (9).

The alternate light sources evaluated in this study did not significantly detect blood or fingerprints. Contrastingly, the chemical developers evaluated in this study did not significantly detect semen, saliva, or urine. When visualized with 410nm to 445nm alternate light sources, semen, saliva, and urine were highly detectable in most scenarios. Fluorescent fingerprint powder was highly effective at detecting fingerprints and averaged near excellent on the usability rating. Hemascein® was notably effective at detecting all contributions of blood during this study and rated excellent on the usability rating.

This study has shown that relatively few pieces of equipment are required for a forensic unit to effectively detect a large array of biological fluids on many different substrates. Throughout this study, these methodologies have also shown to be portable, resilient, and user friendly.

Forensic Detection, Biological Evidence, Portable Methods

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