J3 Studies in Ink Analysis and Line Crossing

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After attending this presentation, attendees will be presented with an example of creating and validating a new analytical capability in their laboratory.

This presentation will impact the forensic science community by presenting an example on determining the suitability of different techniques for ink analysis and line crossing; and validating that analytical capability in their laboratory.

Ink identification and the order of ink layer deposition when lines cross are important determinations confronting questioned document examiners. Before performing case work, individual laboratories need to determine their own capability with the instrumentation on hand, validate analytical protocols, and write standard operating procedures. The results of this study will be used as a guideline for ink analysis in Utah Valley University lab.

A selection of conventional ballpoint and gel pens were purchased from office supply stores. In general, the analytical approach of these experiments is to characterize each line by determining the visible and infrared spectra of each line using a microspectrophotometer, a FTIR microscope, and a Raman microscope. Thin layer chromatography (TLC) was used to visualize the dyes and/or pigments, and examiner impressions of visible microscopic examination of ink deposition at the point of crossing are included. Because not every ink lent itself to unique identification by every analytical technique, a rubrics is used to report the findings of useful application.

Inks of the same color are often made of different combinations of dyes and /or pigments. Although TLC destroys the sample it is useful to answer if two lines were made with the same ink. But it not useful to determine which ink is the top layer when lines cross.

Because gel inks are more fluid, they tend to penetrate paper where ballpoint inks tend to create layers on the paper's surface. Visually, gel inks produce more uniform coverage with little or no raw paper showing, whereas a significant area of uncolored raw paper remains after a line with a ballpoint pen has been written. When a ballpoint line crosses on top of a gel ink line, only a small amount of randomly deposited ballpoint ink is deposited, resulting in a ballpoint line that lacks uniformity and edge definition. However, when the underlying line is made with a ballpoint pen, its line remains distinct and uniform when a gel ink is written over it. Although a gel ink will penetrate and color the raw paper left by the ballpoint ink, it will not disturb the underlying ballpoint ink. Spectral analysis in the visible region of ballpoint inks at the point of line crossing usually is the spectrum of the overlying ink. Inks at the point of crossing were evaluated with visual microscopy, FTIR, and Raman microscopy.

Because not every technique is meaningful with every sample type or situation, a rubric was created to guide appropriate analysis based on the evidence to be examined. Analytical accuracy was determined by comparing analytical results of known sample against the known expectation and the error rate is 100% – analytical accuracy. Robustness was measured by compiling the accuracy of the analytical results of several examiners who each analyze the same samples.

Ink Analysis, Microspectrophotometry, Raman Microspectrometry

 ** Presenting Author*