## B40 Improved Total Nitrite Visualization (TNV) for Gunshot Distance Determination

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After attending this presentation, attendees will better understand the improved TNV technique used to detect nitrites in gunshot distance determination casework. This technique has been shown to significantly increase the ability of analysts to detect nitrites on the clothing of shooting victims and has an increased potential for providing useful distance determination information.

This presentation will impact the forensic science community by illustrating that the TNV method is the best practice for Gunshot Residue (GSR) muzzle-to-target distance casework. This could potentially allow for the detection of residues at farther distances and the development of more accurate nitrite residue patterns, which can expand the value and reliability of cases in which gunshot distance determinations are conducted.

Visualization of residues is an essential part of gunshot distance determination. Typically, the current protocols include the Modified Griess Test (MGT) for nitrites and the Sodium Rhodizonate Test for lead. One problem with gunshot distance determination is that the nitrites that are tested for using the MGT are typically not stable in the environment. In addition, nitrites will only be deposited when partially burned gunpowder particles come into contact with the target, which is less likely at long distances. Unburned gunpowder particles may travel farther than vaporous residues or partially burned gunpowder, but they are not detectable using current MGT protocols. Glattstein et al. demonstrated the ability of alkaline hydrolysis to convert nitrates into nitrites to allow visualization of unburned gunpowder particles using the MGT.[1,2] This is referred to as TNV. This method involves using an adhesive lift of the residues, as well as a one-hour incubation time; however, in a laboratory setting, this method proved to be ineffective on soiled evidence items due to the inability of the adhesive to remove substantial residues. Also, the long incubation time proved to be inefficient in a casework environment.

A validation research study was conducted at the New York City Police Laboratory, which sought to improve upon and apply the TNV method to casework samples. Upon completing this study, it was found that effective results could be obtained using a five- to ten-minute incubation time. This is a significant improvement to the one-hour incubation from the original research. In addition, a direct application method of the hydrolysis reagent was found to be effective on soiled items, eliminating the need for an adhesive transfer. When the TNV method was compared to samples processed using the traditional MGT method, a significant increase in the abundance of nitrite residues was observed.

The TNV procedure was implemented in Gunshot Distance Determination casework at the New York Police Department (NYPD) Police Laboratory. To evaluate the effectiveness of the TNV procedure, reports released before and after the method's implementation were compared. This evaluation found that after the implementation of the TNV method, the percentage of analyzed holes in which nitrite residues were detected increased from 24.7% to 50.9%. In addition, the percentage of cases that contained residues that would allow for a muzzle-to-target distance determination increased from 9.9% to 18.6%.

The results of the validation study and the casework evaluation of the TNV method indicate that it is the best practice for GSR muzzle-to-target distance casework. This could potentially allow for the detection of residues

at farther distances and development of more accurate nitrite residue patterns. Implementing this method can positively influence the criminal justice system by expanding the value and reliability of cases in which gunshot distance determinations are conducted.

**Reference(s):**


1. Glattstein B., Vinokurov A., Levin N., Zeichner A. (2000). Improved method for shooting distance estimation. Part 1. Bullet holes in clothing items. *Journal of Forensic Sciences*, *45*(4), 801-806.
2. Glattstein B., Vinokurov A., Levin N., Zeichner A. (2000). Improved method for shooting distance estimation. Part 2. Bullet holes in objects that cannot be processed in the laboratory. *Journal of Forensic Sciences*, *45*(5), 1000-1008.


**Gunshot Distance Determination, Nitrite, Total Nitrite Visualization**