



E27 A Barrel-Bullet Comparison of Rifling Lines: A Transformation for a Quantifiable Examination Approach

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After attending this presentation, attendees will better understand an innovative method of comparing rifling lines between a weapon barrel and a fired bullet based on three technical aspects: (1) if the direction of rifling lines inside the barrel has the same direction as that of the fired bullet; (2) if the land shape inside the barrel is identical with that of the fired bullet; and, (3) if the width of the land/groove is identical with that on the fired bullet.

This presentation will impact the forensic science community by providing a project result and answer the challenges from the National Academy of Sciences (NAS) 2009 Report, *Strengthening Forensic Science in the United States: A Path Forward*, which states that the firearms examination is “less scientific.” This study was conducted based on a murder from an actual appellant case in a southern state, in which one of the key issues was to confirm whether a .38 Super pistol or a .38 Special revolver was involved. It is contended that the result is able to provide a novel method for the attendees’ future firearm examinations at a crime scene, in the laboratory, and even in courtroom testimony as to whether the bullet found at the scene was fired from the weapon involved.

The firearms examination is challenged by the NAS Report on three major fronts. First, the current examination compares striations only on a fired bullet with these on a test-fired bullet, or the agreement of the striation of the pattern and the minutia. Second, if the fired bullet is retrieved from dirt/sand or walls, many of the striation details on the bullet surface will more likely be lost or damaged, thus making the pattern and the minutia comparison more difficult. Finally, the Report alleges that the examination is “less scientific” due to its nature of being a pattern/minutia comparison, lacking a quantifiable measurement. The Report implies that a conclusion of identification must be made based on a scientific and an objective verification, not on a subjective decision such as patterns and minutia. To qualify as a scientific examination, a conclusion must have an empirical support, an objective methodology, and a quantifiable basis. This presentation provides a preliminary result based on an actual criminal case, using a random sample and employing a digital technique.

It is argued that this study is intended to answer the above three challenges using the 21st-century technology with three unique features: (1) it is a non-destructive method that can be used either before or after the standard examination for either an examination or a verification (a second opinion); (2) the technique can provide a quantitative measurement of the barrel and the bullet, making the examination more reliable and valid; and, (3) the new application can produce a rapid examination at the scene, in the laboratory, and even in the courtroom, adding much-needed support for crime scene technicians and investigators.

The collection occurred in an indoor shooting range based on a subcategory of a random methodology: the target sampling. The actual examination was conducted at a state university campus due to its being a pilot experiment. The preliminary results indicate three findings: (1) contrary to the traditional examination between a bullet and a test fire, this novel method compares a barrel with a bullet, providing a new dimension; (2) instead of the subjective evaluation of images from a comparison microscope, the barrel-bullet comparison is based on a digital examination with up to nine geometric measurements; and, (3) the new method is able to measure the direction of rifling lines, the shape of the land, and the width of the land/groove. If certain conditions exist, this innovative method can even measure the pith of rifling lines inside the barrel and on the bullet, making this a more sufficient and practical examination than traditional examinations. It is argued that if the method were to be additionally tested and finally adopted, our duties and performance will be positively transformed and measured.

Firearms Examination, Rifling Lines, Digital Examination