

## **O8. Pistol Barrel Discrimination: A Numerical Analysis**

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The gross surface profile of barrel land transitions typically change as a result of gun design and manufacturing method, creating a set of characteristic features for discrimination. This research aims to develop a computer-assisted, quantitative method by which land transitions from a range of pistol barrel manufacturers and rifling methods can be compared and potentially identified.

A selection of fifteen 9 x 19 mm calibre pistols were obtained, primarily comprising of barrels with conventional, 6 right class characteristics. Each barrel bore was cast using grey Isomark T-3 silicone polymer and cross-sectioned at three separate locations. Images of the transition regions were obtained at 200x magnification, pre-processed and binarised.

Spectral analysis was undertaken on the binarised images using fast Fourier transform, on which principal component analysis (PCA) was performed. The weighted Euclidian distance (WED) was finally optimised to enhance barrel discrimination.

By calculating WED between any two land transitions, statistically significant differentiation is achieved between 13 barrels (9 barrel manufacturers) using 95 % confidence interval (CI) one-way ANOVA and 95 % Tukey test. Differentiation is further increased to all 15 barrels (11 manufacturers) when WED is calculated between any two trio of land transitions and the CI is raised to 99 %.

This research shows that surface land transition profiles of 11 barrel manufacturers can be quantitatively compared and differentiated, irrespective of typical class characteristics, such as direction of twist and widths of lands and grooves.

There is also the potential to infer the rifling method as well as discriminate between new and used barrels produced by a specific manufacturer, which may be useful to examiners when unmarked or unidentified barrels are encountered.