C16 Comparison of Striated Marks From Slip Joint Pliers

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After attending this presentation, attendees will have a better understanding of the difficulties associated with quantitatively analyzing striated marks such as those produced by ~~a~~ the shear force seen when pliers are used for cutting wire. These marks are much more complex than those seen when using, for example, a screwdriver to mark a piece of lead. A statistical algorithm suitable for analysis of a simple mark has poor results when used to compare more complex marks.

This presentation will impact the forensic science community by showing there is an inherent difference in plier marks as opposed to simple linear toolmarks. It appears that entirely new methods and statistical algorithms will need to be developed in order to reliably characterize shear marks produced by pliers, bolt cutters, garden brush clippers, etc.

Studies have shown that a computer-based system developed at ISU works well when presented with striated marks, such as those made by a screwdriver, where the marks produced are a simple linear array of wide and narrow channels, which are, in essence, a negative of the surface of the screwdriver tip used to make them.[1] However, the problem becomes more difficult when the mark examined is less regular in appearance, such as those made by pliers. Although both are shear marks, it quickly becomes apparent when studying these markings that the plier marks are much more complex. The more complex marking results due to the nature of the cutting process. The cut is produced by the shearing action of two separate plier faces coming together to produce the cutting edge. Similar to screwdrivers, where each side is characteristic, yet different from, the other side, both sides of a plier cut are different. However, as a cut is being made, the cut material is subjected not just to the tip of the cutting plier face on each side, but also the material is dragged across the entire surface of the face during the cutting process. At this time it is highly probable that the original striated surface produced at the very edge of the cut will be altered/changed as the remainder of the plier face shears past it. The resultant mark consists not of a negative of the tip of the cutting face, but is a composite of the plier cutting face and deformation by the surface of the face as it travels through the material to achieve a complete cut.

To study the applicability of the current algorithm to more complex markings, fifty pairs of sequentially manufactured pliers were obtained. The pliers were as identical as possible, being taken directly from the manufacturing line and never used. Alternating sample cuts of lead and copper wire were made using the shear surfaces of the pliers. The cut surfaces of the samples were then scanned using an optical surface profilometer to obtain the surface geometry.

The resulting data files were cleaned to remove background noise, then compared using the statistical algorithm that had proven useful for the comparison of simple striated screwdriver tool marks. The comparisons with the algorithm were divided into three different groupings: known matches, known non-matches from the same pair of pliers (different sides of the cut), and known non-matches from different pairs of pliers. The results of the comparisons varied, and trends could be seen showing known matches had higher scores in general than known non-matches. However, the results are much less definitive than for the more striated marks. The effects of changing data collection locations for comparison as changing comparison parameters showed no clear trends for improvement. The details of these comparisons conducted will be discussed.

Reference:

1. L. S. Chumbley *et al.*, "Validation of Tool Mark Comparisons Obtained Using a Quantitative, Comparative, Statistical Algorithm," *Journal of Forensic Sciences* 55(4), 953–961, 2010.

Slip-Joint Pliers, Tool Mark Comparison, Statistics

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