A117 Differentiating Handsaw Tooth Shape Based on the Analysis of the Kerf Floor Contour

Alexandra R. Klales, PhD, Washburn University, Topeka, KS 66621; Ashley B. Maxwell, PhD, Washburn University, Topeka, KS 66621; Erin Chapman, PhD, Erie County Medical Examiner's Office, Buffalo, NY 14214*

Learning Overview: After attending this presentation, attendees will understand if kerf floor contour can be used to accurately predict handsaw tooth shape in dismemberment cases.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by further validating the work of Symes et al. on saw analyses by indicating whether or not kerf floor shape can be used to reliably predict tooth shape in rip and crosscut handsaws with varying Teeth Per Inch (TPI).[1]

Nearly all dismemberment cases have at least one incomplete cut (a.k.a. false start) available for analysis. The kerf floor and walls contain the most information on class characteristics, including tooth shape: rip vs. crosscut.[1] Rip saws, with flat chiseled teeth at a 90-degree angle, are designed to cut with the grain of wood and produce a U-shaped/concave kerf.[1] Crosscut saws have teeth that are filed usually at 70-degrees with every other tooth being filed on the opposite side. They are designed to cut against the grain of wood and produce a W-shaped/convex kerf.[1] The differences in the contour of the kerf floor are therefore correlated with the differences in tooth design.

This research was designed to answer four questions: (1) Do rip saws always produce a U-shaped kerf floor and do crosscut saws always produce a W-shaped kerf floor? (2) Can kerf floor shape *always* be used to differentiate rip vs. crosscut saws? (3) Does teeth per inch impact visibility of the kerf floor shape? and (4) Does new vs. used blade affect the ability to differentiate saw tooth shape?

Two crosscut and three rip handsaws with alternate set teeth were selected from a local hardware store for the study. Each blade was new and was used by one individual to make 30 consecutive incomplete cuts on dry non-human long bones (n=150 cuts total). Cut order sequence on the bones was randomized and labeled 1–150 prior to beginning, so that the second observer analyzing kerf floor shape did not know which of the five saws or which cut number per saw was being analyzed. Each kerf floor was then blindly analyzed using a digital microscope at 30x magnification. Real-time depth-up composition was used to generate a 3D model of each kerf. Next, the profile function was used to generate a standardized profile contour of each cut along the length of the entire cut. The profile shape was then visually classified by the observer as U-shaped or W-shaped. If any portion of the kerf midline was convex, the cut was classified as a W-shape.

Of the profile contours, 98% (n=147/150) matched the expected shape based on tooth type: rip vs. crosscut. Two crosscut saw cuts and one rip saw cut were misidentified. In the case of one of the misidentified crosscut saw cuts, review of the file revealed that depth had not been calculated at the deepest location within the cut by the 3D function of the microscope; therefore an incorrect kerf floor contour was calculated. The other two misidentified cuts were true misidentifications. In all but one case, the entirety of the cut was U-shaped or wide V-shaped for the rip saws (n=89). Contrary to expectations, the cuts made by crosscut saws varied along the length of the cut from W-shaped to concave, with the more narrow portions of the cut tending to exhibit the flatter or concave shape. This is likely contributed to blade drift of the alternate set saw. However, at least one portion of the cut exhibited a distinct W-shape for accurate identification. Often, one side of the W was uneven, with the peak extending deeper. This was more pronounced with the lower TPI saw. Profile shape for the 30th cut for each saw was compared to the first cut made with each saw. The last cut with each blade was as visible as the first cut for all five saws and, in fact, the misidentified cuts were actually mid-sequence: cut 17/Saw A and cut 10/Saw D. Overall, kerf floor contour can be used to accurately predict handsaw tooth type, and results from this validation correspond to those found by Symes et al.[1] In instances where cuts exhibit both W-shaped and U-shaped sections along the length of the cut, the saw should be classified as a crosscut saw.

Reference(s):

1. Symes, S.A., E.N. Chapman, C.W. Rainwater, L.L. Cabo, and S.M.T. Myster (2010) *Knife and Saw Toolmark Analysis in Bone: A Manual Designed for the Examination of Criminal Mutilation and Dismemberment*. Report, National Institute of Justice, Grant 2005-I-J-CX-K106.

Trauma Analysis, Saws, Dismemberment

*Presenting Author