F15 The Effect of Dental Model Placement on Image Distortion During Scanning for Overlay Production in Digital Bite Mark Analysis

Holland Maness, DMD, 499 Fury's Ferry Road, Martinez, GA 30907; Paula C. Brumit, DDS, PO Box 608, Nocona, TX 76255; Bruce A. Schrader, DDS, 9004 Francia Trail, Austin, TX 78748; and David R. Senn, DDS, University of Texas Health Sciences Center at San Antonio, Center for Education and Research in Forensics, 7703 Floyd Curl Drive, San Antonio, TX 78229-3900*

After attending this presentation, attendees will have learned an appropriate method for cast placement on flatbed scanners to minimize distortion.

This presentation will impact the forensic sciences community by demonstrating the critical nature of proper cast placement for consistent and accurate scanning of casts for bite mark analysis.

Computer generated overlays are an accepted method of comparing exemplars to bite marks by the American Board of Forensic Odontology. Scanning dental casts using a flatbed scanner is a first step in creating the computer generated overlays to be used as exemplars in a methodology outlined in the book Digital Analysis of Bite Mark Evidence by Johansen and Bower. Accurate analysis depends on the accurate capture of scanned digital images of the biting surfaces of the dental casts.

Many flatbed scanners utilitze a charge-coupled device (CCD) sensor. Typical CCD's in flatbed scanners incorporate 6,000 to 8,000 sensors. Newer CCD chips may contain 10,000 or more sensors. The number of sensors determines the highest dot-per-inch resolution that a particular scanner is capable of producing. A traditional flatbed scanner with 6,000 element chip and an 11-inch-wide bed can offer a maximum resolution of 6,000 dpi. When divided by 11, the width in inches of the scanner bed, the overall calculated resolution is approximately 545 dpi. The CCD chip must scan the entire width of the bed with each pass. If the flatbed element chip is 8,000 sensors then the maximum dpi is 725 dpi. Resolution if further limited by lens distortion at the edges of the scan. Only a central strip of the long axis of the scanning bed experiences the full resolution. So although the CCD must scan the entire bed and will reproduce images located anywhere on the glass plate, only that portion running along the central strip will experience full resolution. Full resolution allows accurate reproduction of the image without distortion.

When dental casts are placed on the bed of the flatbed scanner in any position other than the central strip, distortion occurs. Examples of this distortion will be demonstrated. If these images are used for bite mark analysis, this distortion will translate to the computer generated overlays created and an incorrect analysis could result. Consequently, when scanning casts with traditional flatbed scanners, the casts must be placed in the center of the bed. This requirement is in addition to other recommendations outlined by Johansen and Bowers.

Traditionally, scanned images of dental models allow for the analysis of the teeth in a mesial-distal and buccal-lingual dimension (X and Y axes). This methodology does not account for the vertical dimension (Z axis), the relative intrusive or extrusive position of the teeth. Developing technology using digital models instead of stone models, or three dimensional scans of dental models or impressions, may help to eliminate the issue of the failure of the flatbed scanner technique to properly consider X axis information. Three dimensional data capture and analysis is needed to allow for a more accurate representation of the morphology and position of the teeth in all dimensions.

Forensic Odontology, Bite Mark Analysis, Scanned Images

 ** Presenting Author*