F33 Exemplar Creation In Bite Mark Analysis Using Cone Beam Computed Tomography

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After attending this presentation, attendees will learn a new way to gather and use three-dimensional information about the teeth of suspected biters.

This presentation will impact the forensic community by demonstrating a new technique to gather and use three-dimensional information about the teeth of suspected biters.

This pilot study investigates the use of Cone Beam Computed Tomography to assist in bite mark analysis by creating improved exemplars of suspected biters' dentitions that include the consideration of the three- dimensional nature of teeth.

There are numerous ways of producing exemplar overlays to compare biters' dentitions to bite marks. Past and current methods used for bite mark exemplar creation included hand-tracing, xerographic and radiographic methods. Currently, the most widely accepted method is a computer- assisted generation of exemplars using reflected light scans of dental models of suspected biters. This method has been touted as superior to other modalities. Scanners generate digital information by moving a scan head made up of mirrors, lenses, filters, and in high quality scanners, a charged couple device or CCD. The CCD collects light from either a cold cathode fluorescent lamp (CCFL) or a xenon lamp that is reflected from the dental models. This reflected light is not a dependable "reflection" of the actual three-dimensional profile of the biting surfaces of the teeth. The subsequent selection of the areas to be chosen to depict the biting surfaces, whether done manually or computer-aided is markedly subjective. Using the three-dimensional CBCT to help generate a series of two-dimensional exemplars is just the first step toward minimizing the shortcomings of other methods. The ultimate goal is to develop exemplars that will fully and accurately depict the variation of surface contour in the subjects' dentitions at various angles of attack.

With the use of CBCT scans of the biters' dentitions the creation of multiple exemplars of the suspects' dentitions facilitates depicting the variety of angles of attack and depths of attack of the teeth as they contact the bitten substrate. Curt Dailey, DDS, in his 2002 AAFS presentation "The Topographic Mapping of Teeth for Bite Mark Overlays" described a method using selective grinding of suspects' stone dental models. An advantage of the current method is that the three-dimensional images can be sliced and re-sliced at varying angles. Using current technology the slices can be as thin as 0.125 mm.

CBCT scans were taken on ten subjects using a Morita 3-D Accuitomo. Using I-Dixel software axial slices were taken every 0.125, 0.250 and 0.5 mm. For each slice, beginning with the initial contact of the incisors, a depiction of that portion of the teeth was outlined, creating a hollow volume overlay derivative of a method first developed and presented to the AAFS in 1996 by Heidi Christensen, DDS, MS and later published by Bowers and Sweet and Bowers and Johansen. A total of 8 to 16 of the 0.250 mm slices were used which is equivalent to 2 to 4mm of tooth structure from the initial tooth contact. The resulting layers form a pseudo-three dimensional reconstruction of the teeth. When combined the multiple outlines resemble a "topographic map" of the teeth. This method allows the use of different layers generated from varying angles to more accurately compare suspected biters to the bite mark.

This method of constructing overlays is a more accurate and comprehensive method to objectively construct two-dimensional and pseudo three-dimensional overlays. Limitations include the potential lack of access to CBCT for some and the cost of the procedure for others. Additional methods to ameliorate these limitations will be suggested.

Cone Beam CT, Bite Marks, Forensic Odontology