F31 A Mathematical Approach to Bite Mark Analysis Using BiteMark2003 Software© — Phase Two

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The goal of this presentation is to present to the forensic community the continuing research on an objective, mathematical bite mark analysis that can be performed using the aid of a computer program.

In 1952, Doyle v. Texas was the first known case in the United States to reach the appellate level. Since that time, the use of bite mark evidence and evaluation in the justice system has increased dramatically. It has been the goal of the forensic odontology profession to make methods of bite mark analysis more objective and scientific.

Until phase one of this research, bite mark analysis has had no mathematical foundation. In the past, methods most used in this area of study have been empirical in nature by relating the suspected biter's teeth to a photograph of a bite mark.

At the 2003 AAFS meeting, Brumit and McGivney presented a paper that illustrated how a dentition could be described mathematically. The study showed that the mathematical description was unique enough to allow a particular dentition to be specifically identified from other similar dentitions.

This study extends that line of research begun one year ago. In the 2003 study, sets of upper and lower dental models were collected, labeled, digitally imaged and mathematically described. These models were imprinted into a suitable impression medium. The imprints of the dentitions were labeled, digitally imaged and mathematically described as well. Descriptions of the dental models were compared to the mathematical descriptions of the imprints. The results of the comparisons showed that a specific dentition could be linked to the correct imprint.

For this second phase of study, dental models of 20 individuals were obtained. These models were divided into two groups with ten of the individuals having normal occlusion and ten having malocclusions. The teeth chosen to study in each case are premolars, canines and incisors.

After the forty models were selected, they were randomly numbered. Each was imprinted into a suitable impression medium. Different types and consistencies of dental bite wax were used for this portion of the study. The imprints of the dentitions were labeled, digitally imaged and mathematically described.

Each dental model and bite exemplars were scanned at 72 dpi bitmap and saved as bitmap images with a Hewlett Packard Scanjet® 447c 1200dpi/48 bit color flat scanner.

The generation of the mathematical descriptions of the dental models and the imprints was accomplished using BiteMark2003 Software. This software also compared the mathematical descriptions and selected that best matches using a least-squares analysis. BiteMark2003 software was written in Microsoft Visual Basic® 6. The software stores data in a Microsoft Access® 2000 database accessed via ADO data accessibility.

The system to mathematically describe dentitions and dental imprints has been developed and tested. This system demonstrates the usefulness of mathematical descriptions in bite mark analysis. The software used in this system may facilitate the development of a national database. This database could prove useful in the apprehension of serial criminals and in identifying unknown human remains.

The system presents a useful tool to allow the forensic odontologist to properly collect, document and characterize dental evidence in a stepby-step manner. This evidence can then be used to facilitate inclusion or exclusion of suspects.

Bite Mark, Computer, Mathematics

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