



F38 Bite Mark Analysis in the Time of *Daubert*

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At the conclusion of this presentation, the participants will have a general knowledge of the requirement of scientific and technical court testimony and have a general understanding of the examination of fingerprints and bite marks. They will also understand the similarities and differences between these two analyses. The participant will also understand the need for further study in the area of bite mark analysis.

It has been nearly 70 years since the Frye decision setting the standard of "general acceptance" in scientific testimony. During that time both the law and science has changed dramatically.

Scientific testimony under *Daubert* and extending to technical testimony under *Kuhmo Tire* has set standards which science must meet in order to be admissible in a court of law.

These standards are: 1) whether techniques "can be (have been) tested," 2) whether the technique has been "subjected to peer review," 3) the known or potential rate of error...and the existence and maintenance of standards controlling the technique's operation, and 4) general acceptance.

Bite marks are often compared to fingerprints in respect to their uniqueness among individuals. Fingerprint analysis is based on the premises of uniqueness among people, and permanence in the individual.

Fingerprints begin with the formation of friction ridges at the age of 15-17 weeks in utero and do not change throughout life unless changed by some outside force. The uniqueness of fingerprints have been used for over 100 years, first using the intuitive process, then based on the 50x50 study where 50,000 fingerprints, all in loop arrangements and taken from white males were compared with each other. It has been calculated that the chance of duplication of fingerprints is $1:10^{97}$.

The technique of fingerprint examination is: analysis, comparison, evaluation and verification.

Analysis of fingerprints looks at the three levels of detail: general shape, Galton points and minutiae. Also the clarity of the print, and any artifacts that may be present are studied.

In comparison, if the first level of detail agrees then there is the systematic comparison of friction ridge arrangements and specific details.

After comparison the fingerprint examiner evaluates if there is agreement between subjects and exemplar, if there are there discrepancies between subject and exemplar, or is there insufficient data to come to a conclusion.

Lastly the materials are sent to a colleague for review and opinion. Rate of error can be either method error or practitioner error. Method error is that which may be introduced through the processes of analysis.

In the case of fingerprints, utilizing well-established techniques would minimize this. Practitioner error is human error that is the result of the individual fingerprint examiner. This can be minimized by training and experience.

Either of these sources could be identified and corrected by the reevaluation of the fingerprint by another expert.

The rate of error can be calculated by having a large number of examiners evaluate a large number of latent fingerprints and taking the number of errors in relationship to the total number of samples.

The human dentition differs dramatically from friction ridges. While the friction ridges generally do not change throughout life, it is the changes in the dentition from growth, trauma, and wear that individualize the dentition.

There are three areas that demand study to bring bite mark analysis to the scientific level required by *Daubert*. First, there must be large population studies to determine the uniqueness of individual's dentition. Next, the technique used in comparison must be verified, and lastly the examiners must be calibrated as to their rate of error.

There have been some studies regarding the frequency of variation within the dentition, but study of the frequency of variation of the dentition has not been exposed to the rigors of a study in the order of magnitude of the 50X50 fingerprint study.

There are a variety of techniques that have been used in bite mark analysis. Most involve photographs of bite marks or impressions of the bite marks, which are compared with exemplars of a suspect's dentition. This comparison can be through overlays made from radiographs, photocopies, scanned images, bent orthodontic wire and other techniques. There has been a study on accuracy of different techniques by Sweet and Bowers in which they concluded that of the techniques tested, the most accurate method of production of overlays is the computer-based method.

Pretty and Sweet used statistical analysis to determine interexaminer reliability and error rates for the transparent overlays using the computer-based method in their study.

In conclusion, a Scientific Work Group for Bite Marks should be formed similar to those in other disciplines. The group could then direct more scientific studies to validate the findings of Sweet and Bowers, and Pretty and Sweet, but most importantly initiate the extensive research that is needed to show the individuality of the dentition.

Bite Mark, Technical Court Testimony, Fingerprints