F6   Dental Science Assists Criminal Justice

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The goal of this presentation is to inform those attending of the necessity of introducing hard science in bite mark analysis. Otherwise, this valuable resource may no longer be available under the Federal Rules of Evidence.

This presentation will impact the forensic community and/or humanity by discouraging the analysis of indistinct and unremarkable bite marks. It should also encourage further research to elevate the odontologist's opinion to the level of objectivity, by being able to quantify the occurrence of a given tooth pattern in the population.

The *Daubert* decision now gives the court the responsibility for being a gatekeeper. Testimony may be denied unless the Odontologist can scientifically support an opinion of the link between the pattern and a suspect with some degree of objectivity, e.g., based upon a database, the frequency that the dental characteristics observed would be expected to occur in the population. The court is also interested in the error rate among Odontologists. Criticism of bite mark analysis, labeling it as junk science, has come about because of several high profile cases in which the pattern was linked incorrectly to an individual. This sensational journalism barely allowed credit for the many cases that were appropriately accomplished. The problem is not with the comparative science of bite mark analysis, but in the author's opinion with the case selection, the interpretation, and the strength of the testimony given. The present state of knowledge of the frequency distribution of even unusual dental characteristics does not reach the level of individualization. A virtual identification rivaling that of mtDNA would require many years and the analysis of hundreds of thousands of samples. Although it is commonly assumed that the human dentition is unique, a literature search reveals only limited research attempting to demonstrate this scientifically.

Indistinct and unremarkable patterns have been over-interpreted as to their evidentiary value. Presently the Odontologist lacks the ability to quantify the occurrence of even a highly bizarre dental pattern and an opinion should be limited to an expression of probability. The question which arises is, how probable? At the present level of knowledge of dental characteristics, an opinion of probable has only limited value as evidence in that the analysis did not permit an elimination of the subject. A database on the frequency distribution of dental characteristics is necessary to provide hard science to the expression of probability in linking a bite mark pattern to an individual. The *Daubert* factors have raised the bar for the admissibility of this type of testimony.

Currently, a two year, multidisciplinary pilot study is underway utilizing computer analysis of a random sampling of the imprints of the teeth of 400 male volunteers, ages 18 to 44. This team involves the dental school, the law school, the state crime laboratory and computer science. These samples reflect the ethnic makeup (Asian, Black, Hispanic, Native American, and Caucasian) of the general population in the dental school clinic. The imprints are registered, digitally scanned and computer analyzed, to begin the development of a database on six characteristics of the human dentition. The expected outcome of this pilot study is to demonstrate what has presumed to be so, is fact; that is, no two of the dentitions analyzed were shown to be the same. A second goal of this pilot study is to examine both the inter-operator and intra-operator rate, which is another of the questions that the courts and attorneys have. Since bite mark analysis is not an automated process, is there a significant difference between examiners?

Objective assessment of a distinct and remarkable pattern that can presently only be subjectively evaluated will eventually be able to be expressed with objectivity. With the establishment of a database, bite mark analysis could transition into hard science.

If this pilot project validates its hypothesis, "*Investigate, using six measurements, the pattern of each of four hundred samples and calculating the probability that any two would be judged to be the same*", this research is then seen as expanding into a long term effort, eventually involving thousands of samples and the collaboration of many researchers from other laboratories to expand the database.

Research, Bite Marks, Database