F44 Quantification of Individual Characteristics of the Human Dentition: A Preliminary Report

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Attendees will learn the importance of establishing a database which will enable the Odontologist to eliminate the subjective assessment of objective observations in bite mark analysis.

This presentation will impact the forensic community by providing the forensic Odontologist and the criminal justice system with a valuable tool in providing hard science for the objective statement of probability, in either exculpating or incriminating a suspect from patterned injuries caused by human teeth.

Those attending the presentation of this paper will appreciate the importance of establishing a database that will define the frequency a dental characteristic, or group of dental characteristics, occurs in the general population. It is commonly assumed that the each individual's dentition is unique. However, a literature search on the individuality of the human dentition as it relates to human bite marks indicates only a few studies. None, using computer image analysis have been published. .Currently forensic Odontologists, in reporting on bite mark evidence are unable to quantify the frequency the pattern they have objectively observed in their analysis. Their expression of probability or improbability is subjective, lacking a scientific foundation.

This pilot study seeks to demonstrate that, by using computer imaging software and six measurements, the pattern of each of the 400 dental exemplars will be shown to be unique. The significance of this is that with the study of an additional sufficiently large number of dental exemplars, a database could be established that will provide the forensic Odontologist and the criminal justice system with a valuable tool, providing hard science for the objective statement of probability in either exculpating or incriminating a suspect in the analysis of a patterned injury from human teeth.

The sample size (n=400) was derived from power calculations using nQuery Advisor®. A total of 500 exemplars allow for as many as 100 dropouts or unsuitable registrations. Final analysis will be accomplished Statistical Analysis Software (SAS®). They will be collected from randomly selected volunteer dental clinic patients, representing a diverse population of Caucasians, Blacks, Asians and Hispanics that mirrors the general population. All exemplars and subject's history will be recorded using an alpha numeric designation to protect identity and preserve confidentiality. Approval for the project has been granted by the Institutional Review Board and the researchers have completed the Human Participants Protection Education for Research Teams course.

Six dental students have been selected and trained to assist in registering the exemplars and obtaining limited, anonymous histories of any orthodontic treatment, jaw fractures or surgery. The ethnic background of the volunteer is also recorded for use in a study of differences in dental characteristics in ethnic groups.

Since a dental characteristic is not always a random event, each characteristic must be evaluated in relation to its frequency in the population. Some dental characteristics are more likely to occur than others and some are interrelated.

Two imaging specialists from the Wisconsin Department of Justice, State Crime Laboratory have been assigned to the project as consultants and will function to assure that the digital imaging techniques will be in conformity with the standards of the Federal Bureau of Investigation's Scientific Working Group on Imaging Technology (SWGIT). A Professor of Evidence from Marquette University's Law School will serve as a consultant to assure that the information derived from this study will have practical use in the courtroom. Considering also that a Professor of Mathematics and Computer Science and Biostatistician are also serving as consultants, this truly a multidisciplinary team

Currently this project has been awarded "acorn" grants from both the American Board of Forensic Odontology and the California Forensic Dental Association. We are in the process of seeking larger research grants to be able to complete the study, which is anticipated to take two years.

The significance of this pilot research and its impact on forensic science and the criminal justice system is the reduction and eventually through the continued expansion of the numbers of exemplars analyzed, the elimination of the subjective assessment of the linkage of dental characteristics found in bite marks with a suspect.

Database, Quantification, Bite Marks