



F13 An Investigation of the Uniqueness of the Human Dentition

James P. Fancher, DDS, PhD*, PO Box 682, 345 Buie Lane, Martindale, TX 78655; Paula C. Brumit, DDS, PO Box 608, Nocona, TX 76255; and Bruce A. Schrader, DDS, and David R. Senn, DDS, University of Texas Health Sciences Center at San Antonio, Center for Education and Research in Forensics, 7703 Floyd Curl Drive, San Antonio, TX 78229- 3900

After attending this presentation, attendees will be familiar with the value of establishing a database of human dentitions to aid in bite mark analysis and population comparisons. The goal of this pilot study is to use an innovative digital analysis technique to measure key characteristics of the anterior dentitions of selected pre- and post- orthodontic treatment cases. This is designed to validate an approach that may be used to add to an existing relational database of 400 individuals.

This presentation will impact the forensic science community by providing scientific evidence on the question of the uniqueness of the human anterior dentition. This will aid the forensic sciences by providing an objective method to investigate whether two or more individuals have the same anterior dental profile.

One of the key problem areas identified by the 2009 National Academy of Sciences Report *Strengthening Forensic Science in the United States: A Path Forward* is that the uniqueness of the human dentition in relation to bite mark cases has not been scientifically established. To date there have been no comprehensive studies reported that have been conducted on large populations or suitably qualified samples of populations to establish the uniqueness of the human dentition. Additionally, there is no central repository of patterns of human dentitions that can allow the comparison of a suspected biter's dentition with a reference population or sample that can indicate what percentage of the population or subgroup of the population could also have produced a bite or patterned injury. There are two postulates that underlie all bite mark analyses. The first is that the anterior teeth characteristics of a biter are unique. The second is that this uniqueness is accurately recorded in the material bitten. Several statistical and geometric studies have been reported that have each supported the concept of uniqueness of the anterior dentition that are most commonly registered in bite marks. Recent reviews have offered scholarly critiques of the historical studies and have largely concluded that much more work needs to be done to not only establish the uniqueness of the human dentition, but also to address the question of the uniqueness of bite marks. The National Academy of Sciences publication has also pointed out that the circumstances within which the techniques used in forensic odontology can provide probative value warrant research to establish valid evidence to support or nullify assumptions that forensic odontologists have used in bite mark analysis. It has also been noted that following orthodontic treatment the anterior dental pattern becomes more homologous, creating greater difficulty in bite mark perpetrator identification.

The Triservice Orthodontic Residency Program (TORP) at Lackland AFB, TX, has digitized patient records for many years using a non-proprietary file format (STL). In this study a convenience sample of the 50 pre- and post-treatment records are used for analysis using an automated measurement and recording system. All patient identifiers are masked to protect the identity of each patient. The demographic information recorded for each case is age and sex at the time the record was taken. The factors for inclusion in this study are that the records must be of patients 18 years old or older, all 12 anterior teeth must be present (upper and lower incisors and cuspids), and the sex must be male.

The images of the dental models are opened in a three dimensional viewing program. The models are oriented using a Z plane that parallels

the occlusal plane, positioned for optimal viewing, and a two dimensional screen capture is recorded for analysis. The following measurements will be made on each case:

1. The mesio-distal width of each of the maxillary and mandibular incisor teeth
2. The width of each arch from the center point of one canine to the opposite canine
3. The degree of rotation of each of the maxillary and mandibular incisor teeth

The data represented by these measurements is recorded in a relational database. This will give an accurate method of recording the mesial-distal dimension and degree of rotation of each of the maxillary and mandibular incisors, as well as the arch width. This database of descriptive data of each dentition will allow analysis of each case individually and comparative analysis within this sample. The results of this study will contribute to building a database of characteristics of the human anterior dentition and will document changes due to orthodontic treatment. The data from this sample will also help validate methodologies and data already collected.

Unique Dentition, Human Bite Mark, Orthodontic Changes