F20   Image Analysis of Radiographs of Twins for Objective Identification and Individuality

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The objective of this presentation is to examine whether a computer automated method developed to discriminate differences in radiographs of separate individuals for identification is capable of discriminating between inherently similar individuals (monozygotic twins).

Dental identification is often accomplished by comparing dental radiographs of an individual that were generated at different times. Identical twins should be the most difficult sources of similar data to differentiate and therefore identify. The UT-ID computer program objectively compares radiographs to identify the individual and provide a threshold for that identification. This software program provides an objective estimate by first registering the digitized radiographs of the individuals and subsequently performing a cross covariance correlation (CCC) between the registered images. Registration is used to correct for the projection geometry of the radiographs. This computer software eliminates subjectivity in the comparison of radiographs and provides a threshold value that is used to indicate that the images are from the same individual. The computer analysis is objective and can be used as a tool to further substantiate a subjective identification.

This computer-based image analysis system, UTHSCSA Image Tool Software and its plug-in UT-ID (Version 3) developed by S. Brent Dove, DDS, MS, Dental Diagnostic Science, UTHSCSA, San Antonio, TX, were used to objectively compare the radiographic images of identical twins to determine individuality. Fraternal twins were used as a control group. Fraternal twins would be expected to be less similar but still more alike than random individuals of the general population. UT-ID provides the cross covariance correlation (CCC) range to define the threshold for determining objective identification for these subjects.

In two previous studies presented at AAFS meetings, UTHSCSA Image Tool software provided perfect and near perfect discrimination between radiographic images in a laboratory and clinical setting respectively. Registering the images and performing cross covariance correlation (CCC) between the registered images produced a threshold indicative of positive identification. As more data are analyzed, the cross covariance correlation threshold can be further refined.

Radiographs were utilized consisting of selected areas of full mouth series, single periapical radiographs, bitewing radiographs and areas of panoramic radiographs. Each twin had the same area analyzed that was supplied by the dentist of record. Time frame and age were as closely matched as the records permitted. Restorative treatments that would differentiate the twins were not utilized. Only common anatomical areas that could be compared were selected to be studied. These areas of the radiographs were then digitized on a flatbed scanner with transparency adapter at 400 dpi. These digitally scanned images, from the same anatomical area are then registered for each subject identical and fraternal twin. These images were compared to the corresponding images of control identical and fraternal twins and differences and similarities noted. The cross covariance correlation is determined by the program for the compared films and compared to a threshold value that is used to indicate identification.

UT-ID and the objective data it generates can be used to identify individuals from similar radiographic studies. Results indicated that the identical twins while more similar could still be differentiated from each other without reliance on restorative treatments. Fraternal twins were more easily differentiated from each other. Identity is not an issue that can be determined by statistics, probabilities or computer programs alone. In this study population, no two people were identical and the radiographs from each of these subjects were unique (like no other). Radiographic information is important, but may differ in the amount of information present. It is therefore the scientist who must make the identification. UT-ID provides an objective tool for scientists to facilitate identifications using radiographic information.

Dental Identification, Monozygotic Twins, Computer Identification