F3 Personal Identification by Morphometric Analyzes of Intra-Oral Radiographs of Unrestricted Teeth

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The goal of this presentation is to elaborate a biometric method for personal identification, comparing digital intra-oral radiographs simulating antemortem and postmortem data.

This presentation will impact the forensic community by underlining the importance of the use of a morphometric analysis in odontological identification.

Introduction: Routine means of identification includes visual recognition, clothing, personal artifacts, fingerprints, DNA matching and also skeletal and dental examinations.

In particular intra-oral radiology is an important tool for victims' identification.

It is based on the comparison between antemortem and postmortem radiographs, looking for individual distinctive features, such as morphology and pathology of teeth and alveolar bone, and details of dental restorations.

Dental treatments, in fact, result in specific and individually characteristic restorations, which for the most part are well depicted on intraoral radiographs.

However, nowadays, preventive interventions have reduced the number of dental restorations. The change in dental health status has interfered with the discriminating potential of dental restorations, which is apt to make conventional forensic dentistry less powerful.

In this way obtaining a positive match by using methods based on manual comparison of intra-oral radiographs without restorations is more difficult.

The aim of this study was to elaborate a biometric method for personal identification by comparing simulating antemortem and postmortem digital intra-oral radiographs, using a computer analysis of dental anatomical structures.

Materials and Methods: The sample consisted of 140 digital intra- oral radiographs (70 subjects) carried out by RVG using long cone technique Rinn aim rings and bite-blocks.

In the application of this method, measurements were taken only on inferior right first molars with no restorations.

From the beginning two points of the cemento-enamel junction (CEJ1-CEJ2) were recognized for tracing the straight line that joins those points; subsequently, at this line was carried the perpendicular from distal cemento-enamel junction intersecting profile of distal root in the most apical point (R1). From this point was carried the parallel to the straight line connecting CEJ1 and CEJ2 intersecting profile of mesial root in most external point (R2). Traced the straight line connecting R2 and CEJ2 the diagonals of obtained quadrilateral were drawn; they locate radicular furcation point (F).

Both passages - design drawing of the line and the acquisition of intra- oral radiographs - were effectuated by digital systematic research using a specific dental software.

After making a quality selection of the images, they were submitted to morphometric analysis using dedicated software.

Following the operative protocol, 5 previously located reference points were identified and marked by the software on every acquired intra- oral radiograph.

The program then automatically supplies values of the absolute distances, the relative distances, the shape factors, the moments, the perimeter values and the areas of the triangles obtained by joining the points. Six numerical sets were thus obtained for each image.

Statistical comparison was made of the sets by the linear regression, determining the correlation coefficient

Cross-analysis was made on each of the six numerical sets obtained from the 140 images (70 patients X 2), yielding 29400 comparisons (6 X 70 X 70) for heterologous correlations and 420 comparisons for homologous correlations (6 X 70).

Results: Analyzes showed that the areas of the triangles, the shape factors and the moments did not serve for identification purposes due to overlapping, the maximum values for the correlation coefficient in the heterologous comparisons being in the same range as those for the homologous comparisons in a lot of samples.

On the contrary, cross comparison of the correlation coefficients for the sets of absolute and relative distances, and perimeters showed that they could potentially be useful, possibly in association with other analyzes, for identification purposes.

The numerical results were:

- The correlation coefficients for autocorrelations for the absolute distances was 0.9999
- The correlation coefficients for autocorrelations for the relative distances was 0.9999
- The correlation coefficients for autocorrelations for the triangle perimeters was 0.9999
- The correlation coefficients for heterocorelations for the absolute distances was between 0.9855 and 0.9997

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- The correlation coefficients for heterocorelations for the relative distances was between 0.9783 and 0.9996
- The correlation coefficients for heterocorelations for the triangle perimeters was between 0.9798 and 0.9996

The results indicate that:

- The section point for the output of comparison of the absolute distances is 0.9997; higher correlation coefficients indicate certain identification and lower values certain exclusion.
- The section point for the output of comparison of the relative distances is 0.9996; higher correlation coefficients indicate certain identification and lower values certain exclusion.
- The section point for the output of comparison of the triangle perimeters is 0.9996; higher correlation coefficients indicate certain identification and lower values certain exclusion.

Thus it can be concluded that if the comparison of two intraoral radiographs yields a higher correlation coefficient than minimum threshold for autocorrelation of the absolute distances, relative distances and triangle perimeters, there is a clear identification.

Morphomemetric Analyzes, Forensic Odontology, Intra-Oral Radiographs

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