Superimposition Technique in Human Identification: Case Reports

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Abstract

Individual identification is one of the main objectives of the forensic anthropological examination of human remains. Authoritative techniques are used in the comparison between the recorded data gathered during one's life and the data obtained by examining the corpse. The superimposition technique, frequently used in the craniofacial segment, was applied in the maxillomandibular segment in the cases presented herein. Studies on bi-dimensional photographic superimposition were performed by means of computer-generated images, using Adobe® Photoshop® CS 6.0 © (1990-2003 Adobe Systems Incorporated) for Windows. Image superposition can be an auxiliary means in the identification process and greatly contributed to the conclusion of the forensics of individual identification.

Keywords: Forensic medicine • Forensic anthropology • Forensic dentistry • Superimposition • Computer-aided image processing

Introduction

The identification of human remains represents one of the main objectives of forensic anthropology expertise [1]. Several techniques can be used for this purpose [2].

Carbonized bodies, quartered, mutilated, and in an advanced state of putrefaction, are received at the Institutes of Forensic Medicine [3].

Forensic anthropological techniques to estimate sex, age, ancestry and stature are applied, following an established protocol [3].

To establish the individual identity, it is necessary to have life records of the individual, such as dental records, radiographs, photographs, individual characteristics (tattoos, scars, bone deformity, presence of prostheses, etc.), allowing comparison with findings from the examination on the corpse [4].

In the absence of dental records, the only available ante-mortem elements are often photographs [5].

The superimposition of computerized photographic images, widely applied to the craniofacial segment, may offer to the forensic anthropology expertise an important resource for successful identification [6,7].

Case Reports

Case 1

January, 2009: an incomplete skeleton, with dry and odorless bones. A

forensic anthropological study concluded that it was a human skeleton, female, aged over 60 years, stature of about 1.60 m, ancestry predominantly from the Caucasoid group, completely edentulous.

A disused upper-arch dental prosthesis was received from the relatives of a 71-year-old woman who has disappeared since 2008.

Moldings of the internal surface of the upper prosthesis, using condensation silicone (heavy type) and irreversible hydrocolloid, allowed the obtainment of a model made in type 3 stone plaster, representing the anatomical surface of the moldable area of the user's jaw.

Anatomical comparisons between the prosthesis received and the skull showed complete coincidence through adaptation of the prosthesis to the skull. The alignment and relief of the upper alveolar ridge and the palate were also coincident with that of the plaster model's adaptation surface through the superimposition of images (Figure 1).

Case 2

June, 2010: a carbonized corpse with calcination of limbs. After anatomical restoration of the skull, a forensic anthropological study of the skeleton concluded to belong to the human species, female, estimated age between 14 to 19 years, stature of about 1.60 m, undetermined ancestry.

Photographs, front and left, of poor technical quality, and a hairbrush for use by a young female (for forensic hair comparison), 15 years old, missing for about 20 days, were sent by relatives.

The superimposition of digitalized images of the skull, taken in the left lateral profile, and the digitalized photo of the young woman's head revealed a craniofacial anatomical coincidence.

Anatomical coincidence was also observed between the upper dental arch of the skull and the apparent upper dentition in the photos received, from the front and left profile, digitized and enlarged, through image superimposition (Figure 2).

Both photographic superimpositions were performed by means of a computerized image, using the program Adobe® Photoshop® CS 6.0 © (1990-2003 Adobe Systems Incorporated), in its version for the Windows system.

Figure 1. Superimposition between the images of the upper alveolar ridge and the upper prosthesis mold showing anatomical coincidence.
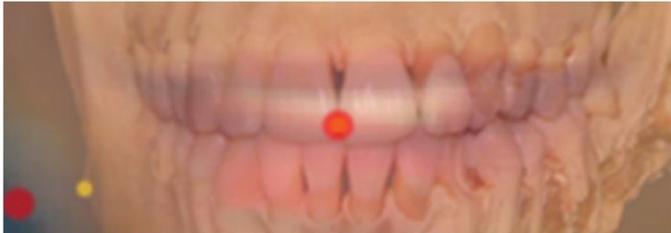

Figure 2. Superimposition between photo of poor technical quality and scanned front skull images, marked with facial (red) and craniometric (yellow) points.

Results and Discussion

The literature records numerous cases where the superimposition of images was used in forensic identification.

According to Coma, it was Welcker who first described this technique (to study the skull of the poet Dante Alighieri), considered auxiliary, but which, eventually, may represent an important resource in the process of individual identification [8].

In Brazil, Silva (1932) recommended a method of identifying the photographs of the suspects to whom the skulls belonged, carrying out a prosopographical study, comparing craniometric points of the skulls with corresponding points in the suspects' photographs [9] (Figure 3).

In 1935, the Ruxton case, of great repercussion, had the identification of the two homicide victims carried out using the craniofacial photographic superimposition technique [10].

In the 1990s, there were studies showing the use of computerized images to assist this technique [11,12].

Presence of teeth in the skull and photographs with the individual's apparent teeth facilitate the comparison, providing much more accurate results [5].

Mackenna et al. consider that with these aspects present, a categorical or unambiguous identification can be obtained. Otherwise, the identification would be impaired and could only be classified as highly probable or just consistent. In cases where the identification by the aforesaid technique is classified only as consistent, the presence of other evidence can allow a satisfactory conclusion [13].

In a recent article focusing on new developments in facial photographic superimposition, Ubelaker, Wu and Cord state, in their conclusions, what represents a great reality in developing countries [14]:

"Use of these techniques has been marginalized in some regions in favor of molecular analysis aimed at identification. However, interest remains strong in many parts of the world where DNA laboratories are less available or cost prohibitive. Economic issues also are associated with the new technological advances in craniofacial superimposition since some require equipment not universally available".
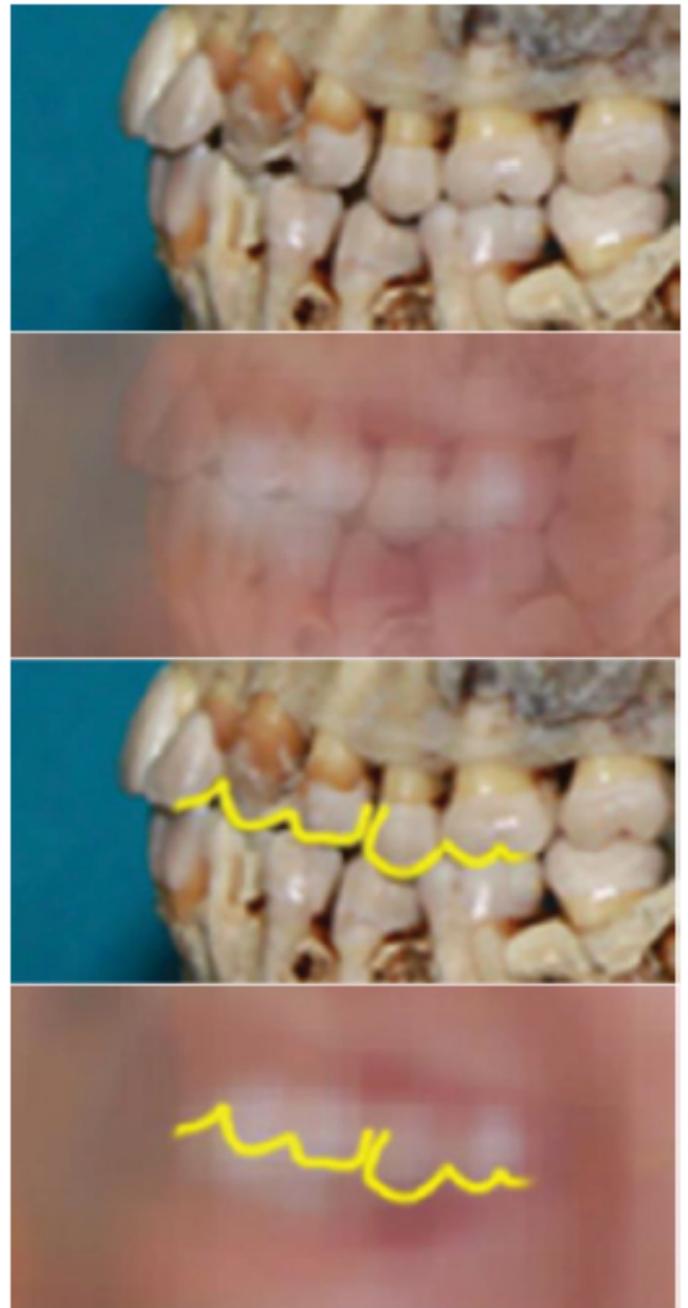

Figure 3. Superimposition between scanned photo of poor technical quality and skull in left profile, showing transposition of the upper dental contour line.

Conclusion

The application of the photographic superimposition technique, as described herein, in both cases allows a favorable conclusion to the importance of the anatomical individuality character of the maxillomandibular complex,

mainly due to the significant anatomical particularity of human teeth, normal or altered by morbidities or by treatments, making it possible to achieve a high degree of scientific certainty in comparative studies.

Image superimposition techniques, often used to study anatomical correspondence between the skull skeleton and the soft tissues of the face, allow them to be applied to anatomical segments, contributing to the certainty of the expert conclusion and representing still an economically viable and reasonably safe technique.

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