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Case Report Open Access

Superimposing Images of the Smile on Carbonised Remains for Human Identification Purposes

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Abstract

The easy access to electronic devices with high-quality cameras and the widespread use of social network have been changing the forensic dental and anthropological analysis in human identification massively, especially related to dental and facial superimposition methods. The methodology of smile superimposition consists of the comparison of ante mortem (AM) and post-mortem (PM) smile images showing dental traits especially the superior incisor and canines. These methods are an important forensic tool especially when there are no medical and or dental records. The present paper reports a case of a positive human identification using the smile line and superimposition of the teeth techniques on carbonized human dental remains.

A carbonized body of male adult found in the trunk of a car was send to the Medico-Legal Institute, where forensic dental and anthropological analysis were carried out. The family of the victim could only provide two smiling pictures of the man from social media. The dental superimposition showed concordance between the AM and PM photograph smile lines, matching dental traits such as incisive dental crowding and respective angle as well as the presence of white spots. The aim of this report is to highlight the effectiveness of the use of smile superimposition images to identify heavily carbonized human remains especially when no other data is available.

Keywords: Superimposition of the teeth; Human identification; Forensic dentistry; Carbonized remains; Low-cost method; AM and PM confrontation; Smile line

Introduction

Easy access to electronic devices with high-quality cameras and the widespread use of social networks have been changing the forensic dental and anthropological analysis in human identification massively, especially related to dental and facial superimposition methods.

Technological evolution has occurred in parallel with forensic methods themselves, along with the development of alternative methods for comparison of AM and PM data.

Human identification is one of the most crucial aims in forensic dentistry and forensic anthropology. Dental analysis is a reliable, simple, effective and low-cost method [1-4].

However, like any other forensic technique there are limitations and issues such as the quality of photographs, the number of available dental traits as well as AM dental modification after the taking of the picture [1,4] consequently, the work of an expert is required [5].

Dental morphology is so unique that its traits can be considered as reliable as fingerprints [6] based on the fact that there are no similar dental arcades. In addition, the number of morphological concordant points or similar characteristics to reach identification in the dental forensic analysis is highly variable [3,6].

The smile line superimposition and superimposition of the teeth methods consist of the comparison of pre and post-mortem dental contours with the aid of virtual approaches. This technique is an important forensic tool especially when there are no medical and or dental records, showing reliable results [2,3,6], however, the knowledge of the limitations of superimposition methods and their applicability is crucial [1,7].

The aim of this report is to highlight the effectiveness of the use of smile superimposition images to identify heavily carbonized human remains.

Case Report

Partially carbonized human remains of a male adult were found in the trunk of a car and sent to the Medico-Legal Institute, where forensic dental and anthropological analyses were carried out. The family of the supposed victim had no previous medical or dental records; however, they were able to provide two smiling pictures from social media showing the individual´s teeth from two different angles (Figures 1A-1C).

The forensic anthropological analysis was moderately hindered by the degree of carbonization however, the analysis estimated that the individual's sex and age: A male of 25-year-old (average) and the skull presented blunt force trauma, however, stature and ancestry estimations were not possible.

Despite the degree of carbonization of the remains the dentition was well preserved and the forensic dentistry team could analyse the

morphology of the dental remains, such as teeth size, width, contours, margin anomalies as well as teeth placement, spaces, and dental alignment (Figures 1B and 1D).

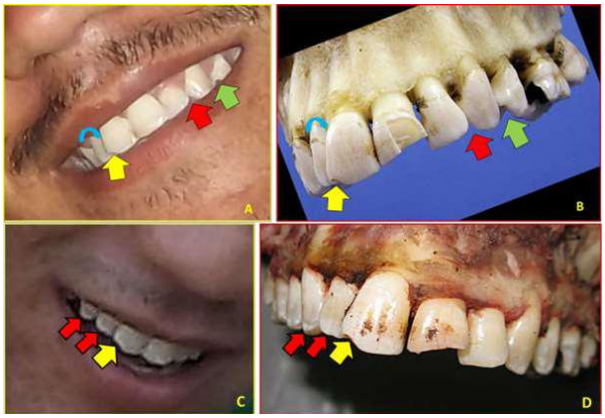

Figure 1: (A and C) AM images of smiling pictures provided by the victim´s family. **(B and D)** Superior arcade of the carbonised remains for confrontation. Comparison of AM and PM traits: The yellow arrows show a distal angle fracture at the tooth 11; the red arrows are showing the white spots, the green and curved blue arrows A and B demonstrate similar pattern of crowding on the maxillary left canine (23) and first premolar (24) (green arrow) and the crowding of lateral incisive (12) (blue curved arrow).

Following the protocol and suggestions of De Angelis [2,8-10], the post-mortem images were taken from the same angle/position as the pictures provided. Subsequently the images were treated using the program Adobe Photoshop® CC to perform the smile line superimposition and superimposition of the teeth techniques for comparison AM and PM (Figure 2).

Following the protocol, the "smile line", an outline from canine to the canine of the anterior maxilla, was drawn on the AM and PM images and then compared (Figures 2A and 2B). Dental superimposition AM and PM confrontation can be seen in the Figures 2C and 2D, AM and PM respectively.

The comparison showed the following concordant points: crowding of incisive teeth (11, 12, 21, 22), the same white spots considered individualization traits, consequently the smile line superimposition technique demonstrated that the images of the missing person and the image of the remains showed compatibility (Figures 1 and 2).

As can be seen in the Figures 1 and 2, the fracture of the incisor third of incisive central left superior (21), is the only discordant feature as it is not present in the AM images. However, the dentistry forensic analysis classified the fracture as perimortem due to its morphology.

This feature led us to report this discordant point as non-coincident instead an excluding trait, confirming a high accuracy of the AM and PM comparison.

Following ethical principles, the family of the victim family signed a consent document authorising the use of images and report information for research and academic publication purposes.

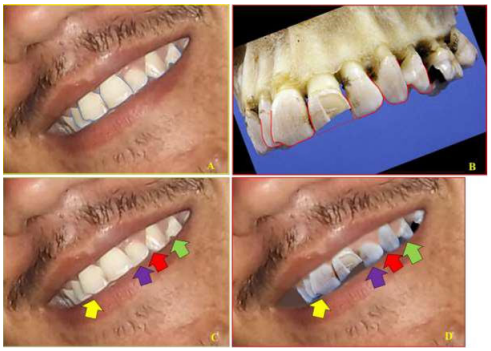

Figure 2: (A and B) Smile line of AM (A) and PM (B), note the similar aspects of the inferior margins of lateral incisive and superior canine on the left side (22 and 23), as well as the crowding of lateral incisive (12) the fracture of the distal angle of tooth 11th. **(C and D)** The superimposition of the teeth and concordant point are shown in C and D.

Discussion and Conclusion

Homicides in Brazil are unfortunately frequent, the year of 2016 showed the alarming number of 62 thousand homicides, i.e., 30.3 deaths per 100,000 and routinely laboratories of forensic anthropology and dentistry receive cases with no or little antemortem information. A similar pattern has been reported in the European migrant crisis.

New challenges have been driving forensic anthropologists to explore innovative approaches. Online smiling photographs especially when shared on social media have become widespread and forensic science and forensic dentistry has been adopting and developing reliable protocols for dental image superimposition in human identification process. Identification through smile superimposition has been a successful method when applied in certain conditions.

Unlike craniofacial superimposition techniques, which remain controversial within forensic scientists, smile superimposition is considered reliable since the hard tissue (teeth) is exposed allowing direct comparison. The soft tissue depth is an important source of uncertainty in craniofacial superimposition methods however; the chances of success in this method are associated with the visualizations of the upper teeth.

The technique of smile superimposition consists of the comparison of AM and PM smile images showing dental traits, especially the superior incisors and canines. Dental morphology e.g., teeth dimensions, size, width, contours, lesions, colouration, stains are unique permitting a reliable AM and PM data comparison however, training and awareness are essential to reach highly accurate results.

This case reports a case of human identification using the superimposition of a smile line, strengthening the reliability of this technique especially when dental and medical records are not available.

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