Case Report

Dental Cingulum and Position of Fixed Orthodontic Appliance as Source of Morphological and Therapeutic Identifiers: An Unusual Case Report

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Abstract

Orthodontic records, such as photographs, radiographs, and dental casts, provide information useful for identification purposes because it may reveal important morphological, therapeutic, and pathological dental identifiers. Among these identifiers, the type and position of orthodontic appliances figure as distinctive tools for human identification. In this context, the present study aims to report an uncommon case of identification of a putrefied body, found near to a forest region in Brazil. The postmortem (PM) examination showed that the victim had part of a fixed orthodontic appliance installed in the maxillary and mandibular dental arches. To identify the body, relatives of the potential victim presented orthodontic examinations containing panoramic radiography and photographs of the orthodontic treatment. The body was identified based on the analysis of the radiographs and photographs that confirmed the presence of the orthodontic appliances observed PM. More specifically, the identification was supported by the analysis of bracket bonding position of the maxillary and mandibular incisors and the presence of distinctive morphological traits of the canines and incisors, as well dental roots observed radiographically. The present case highlights the importance of orthodontic records as a source of morphological dental identifiers for cases in which only unrestored teeth are available.

Key words: Dental records, forensic anthropology, forensic dentistry, orthodontics

Introduction

In Brazil, it is estimated that 44,861 people were killed by firearms only in 2014.[1] Following the increasing rate of violent deaths, a large number of skeletal remains, putrefied and decomposed bodies are observed[2,3] for forensic investigations in medicolegal departments. Yet, these investigations include searching the cause of death, weapons related to the crime, and victim's identity. Specifically for human identification, fingerprint, dental, and DNA

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analysis may be performed in accordance with INTERPOL guidelines.[4] Dental analysis is founded on the comparison of morphological, therapeutic, and pathological identifiers between antemortem (AM) and postmortem (PM) data.[5,6] The comparative procedure aims to link a deceased body to a missing person through the concordance of identifiers. In this context, dental human identification plays an essential part, especially in cases where AM data are available and the analysis of fingerprints is not feasible.

In certain cases, identifiers may be scarce.[2] Moreover, in the near future, therapeutic identifiers may become even less common owing to the rise of preventive dentistry worldwide.[7,8] The opposite is observed in orthodontics. In Brazil, nearly 65% of the adolescents are affected with malocclusions that require orthodontic correction[9] – out of which 69% are willing to undergo treatment.[10] From a forensic scope, the AM/PM comparisons performed with orthodontic records may be carefully interpreted because they often reveal explainable discrepancies,[11] such as crowded teeth AM but aligned PM. On the other hand, orthodontics may be a valuable source of AM data, such as radiographs, photographs, and dental casts obtained before, during, and after treatment.[5,12-14] In addition, it also provides other ranges of identifiers highly useful that are not commonly explored in practice, such as the quantity, type, and position of fixed appliances.

INTERPOL includes the fixed orthodontic appliances among the identifiers coded for human identification purposes. In order to encourage the use of these identifiers, the present study reports a case of positive human identification reached through the comparison and combination of therapeutic orthodontic identifiers and dental morphology.

Case Report

In 2016, an unknown body highly decomposed was found in a forest region in the State of Goias, Brazil. After crime scene investigation, the body was referred to the local medicolegal department for the investigations on the cause of death and identification.

In the absence of fingerprints, dental identification was conducted. After cleaning the human remains, the jaws were examined showing several dental features (Federation Dentaire Internationale notation): well-developed cingulum in the upper right lateral incisor (#12) and canine (#13), as well in the upper left canine (#23); upper and lower third molars partially erupted with incomplete roots; orthodontic brackets from upper right central incisor (#11) to canine (#13), from lower right central incisor (#41) to canine (#43), and in the lower left lateral incisor (#32). Orthodontic wires were missing. Empty sockets revealed the upper left central (#21) and lateral incisors (#22) missing PM. Photographic registration of the body and identifiers was performed with a Nikon D7000 digital camera (Nikon Corporation, Tokyo, Japan) using Nikkor 105mm lenses (Nikon Corporation, Tokyo, Japan), while panoramic radiographs were taken with a Dabi Atlante eagle (Dabi Atlante, Sao Paulo, Brazil) radiologic device.

Police investigations pointed as potential victim a male subject aged 21 years old with 69 days missing. Relatives of the missing person provided dental records that consisted of intra- and extraoral photographs and panoramic radiograph dating from 2012. These images revealed well-developed cingulum in the teeth #12, #13, #22, and #23; unerupted third molars with incomplete roots – which presented developmental stage compatible with the victim's age in 2012. All the other teeth were unrestored with no distinctive morphological traits. Orthodontic brackets with leveling wires were observed in all the teeth except third molars. The occlusal relation observed through the photographs corresponded to Angle's Class II, with overbite nearly absent and open bite bilaterally in the region of premolars.

The AM/PM comparison of morphological traits observed in radiographs and photographs showed concordances [Table 1], more specifically regarding the root shape of the lower first and second molars, as well the prominent cingulum in the upper incisors and canines [Figures 1 and 2].

In order to better investigate the orthodontic identifiers, the AM and PM photographs were imported into Adobe Photoshop CS6 (Adobe Systems Inc., San Jose, California, USA) software package. Both images were resized and scaled using the tooth #11 as reference. With a pencil tool, the incisal edges of the anterior teeth were outlined in color (yellow for AM and pink for PM). The same was performed in the upper surface of the brackets bonded in these teeth [Figure 3].

The AM and PM outlines were superimposed in layers using the same software package. The superimposition showed that not only the line of the brackets were matching but also their position [Figure 4]. Considering the similarities found and the lack of unexplainable discrepancies, positive identification was established.

Discussion

The identification of human remains through dental traits is a well-established procedure performed routinely in medicolegal institutes internationally, especially when the deceased bodies are affected by cadaveric alterations (e.g. charred, putrefied, and decomposed).[15] In Brazilian morgues, dental human identification is the first choice when fingerprints are not available. The present case confirms the effectiveness of dental human identification in the forensic practice.

Several case reports using therapeutic identifiers[6,14,16] are found in the literature and corroborate the value of these

Table 1: Antemortem and postmortem evidence and related outcome

Tooth number	AM	PM	Outcome
11	Unrestored[a]	Unrestored[a]	Similarity
12	Unrestored[a]; prominent cingulum	Unrestored[a]; prominent cingulum	Similarity
13	Unrestored[a]; prominent cingulum	Unrestored[a]; prominent cingulum	Similarity
14	Unrestored[a]	Unrestored	Similarity
15	Unrestored[a]	Unrestored	Similarity
16	Unrestored	Unrestored	Similarity
17	Unrestored	Unrestored	Similarity
18	Unerupted	Partially erupted	Explainable discrepancy
21	Unrestored[a]	Missing	Explainable discrepancy
22	Unrestored[a]; prominent cingulum	Missing	Explainable discrepancy
23	Unrestored[a]; prominent cingulum	Unrestored; prominent cingulum	Similarity
24	Unrestored[a]	Unrestored	Similarity
25	Unrestored[a]	Unrestored	Similarity
26	Unrestored	Unrestored	Similarity
27	Unrestored	Unrestored	Similarity
28	Unerupted	Partially erupted	Explainable discrepancy
31	Unrestored[a]	Unrestored	Similarity
32	Unrestored[a]	Unrestored[a]	Similarity
33	Unrestored[a]	Unrestored	Similarity
34	Unrestored[a]	Unrestored	Similarity
35	Unrestored[a]	Unrestored	Similarity
36	Unrestored	Unrestored	Similarity
37	Unrestored	Unrestored	Similarity
38	Unerupted	Unerupted	Similarity
41	Unrestored[a]	Unrestored[a]	Similarity
42	Unrestored[a]	Unrestored[a]	Similarity
43	Unrestored[a]	Unrestored	Similarity
44	Unrestored[a]	Unrestored	Similarity
45	Unrestored[a]	Unrestored	Similarity
46	Unrestored	Unrestored	Similarity
47	Unrestored	Unrestored	Similarity
48	Unerupted	Unerupted	Similarity

[a]Teeth with fixed orthodontic appliance bonded. AM: Antemortem, PM: Postmortem

identifiers in forensic dentistry. Regarding the morphology, case reports focus more often in the distinctive traits detected in the frontal sinuses and incisal edges of the anterior teeth in smile photographs,[3,17,18] although there is some of them that emphasizes the role of some dental anomalies in order to make the human identification process easier.[19] The present study explored the interface of therapeutic and morphological identifiers, highlighting the distinctive crown traits observed in the upper incisors and molar roots with the positional and structural traits of the orthodontic brackets. Predicting the importance of orthodontics in human identification, INTERPOL designed specific dental codes for fixed and removable appliances.[5] Despite that, the literature is considerably scarce in the use of orthodontic records for human identification. Even when used in forensics, the orthodontic information is restricted to the comparison of radiographs, photographs, and dental casts but not specifically the brackets. The presence of orthodontic appliances is itself an identifier already, but the information retrieved from the bonding position and shape of the brackets has even more potential for a highly distinctive information for comparative human identification.

Most of the orthodontic treatments for the alignment of teeth are performed with fixed appliances (brackets) bonded in the dental crowns. These appliances transfer the physical forces to the teeth and promote movement. The most traditional way to bond brackets of the tooth surface is manually through direct positioning. Despite the broad variety of techniques and instruments available to enable bracket bonding, this procedure remains subjective depending on the dentist's skills and knowledge, tooth position, and angulation in the arch and crown size and shape.[20] In this context, orthodontic appliances may contribute to the identification process adding distinctiveness to the dental traits.

When analyzed in the face to morphological traits, the brackets may be observed in their relative position. In the present study, this position was analyzed considering the incisal edges of the anterior teeth. Moreover, the bracket outline may be taken together with the outline of the incisal edges.[3] Currently, techniques are applied to retrieve the morphological outline of the incisal edges of the anterior teeth. However, this technique analyzes the anterior teeth combined. In the present case, the incisal edge of each tooth was analyzed separately to avoid the explainable discrepancies that result from the orthodontic treatment AM and PM. Explainable discrepancies not only remain in the position of teeth AM and PM but also in the bracket itself. Orthodontic appliances may be changed during the treatment and replaced. Considering the several aspects that may influence on bracket bonding described above, the new bracket-bonded perimortem may be in a different position observed AM.

It is important to note that the present study focused on highlighting the use of orthodontic appliances for human identification, but the positive outcomes from the comparison between AM and PM were founded also on other distinctive traits observed in the victim. The root morphology of molars and prominent cingulum of the upper anterior teeth played a valuable part in the present case contributing toward the identification of the victim. Based on the above, this case report encourages using a combination of therapeutic and morphological dental identifiers for human identifications supported by distinctive evidence.

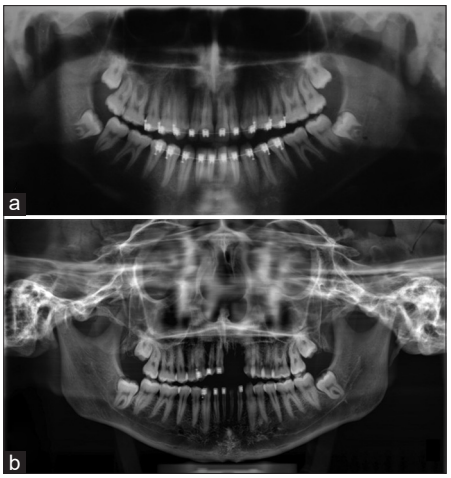

Figure 1: Comparison of antemortem (a) and postmortem (b) panoramic radiographs

Figure 2: Occlusal photographs antemortem (a) and postmortem (b) in which the prominent cingulum of the teeth #12, #13, and #23 is observed

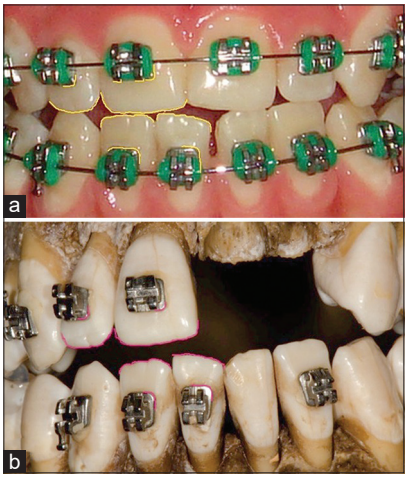

Figure 3: Incisal edges outlined in yellow (a: antemortem) and pink (b: postmortem)

Figure 4: Yellow (antemortem) and pink (postmortem) outlines superimposed and matching

Conclusion

Despite the common use of therapeutic dental identifiers for human identification, the current trend of preventive dentistry will result in an increased rate of cases founded on morphological identifiers. Orthodontics offers the possibility of combining both therapeutic and morphological identifiers to support more reliably a forensic case. The present study highlighted and illustrated the importance of morphological dental traits and orthodontic appliances for the identification of a decomposed body with no fingerprints and several unrestored teeth.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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