

Dental Profiling in Dental Autopsy: Case Report

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Abstract

Forensic dentistry deals with identifying human remains after homicides, accidents, wars or natural calamities. It has been established that dental indicators can assist in successfully identifying. The study of teeth and the surrounding tissues of the oral cavity in order to establish the identity of a victim are known as dental profiling. The following case report highlights the need to properly examine all the specimen and record minute details. It has been seen that teeth can play a vital role in estimating the age, sex, race, socio-economic status, personal habits, oral and systemic health, occupation and dietary status of an individual.

Keywords: Forensic dentistry; Forensic odontology; Dental profiling; Dental autopsy.

Introduction

One of the pivotal role of Forensic Dentist is to aid in identification of the deceased. There exists various methods like radiographic examination, postmortem dental profiling and DNA analysis to perform person identification.¹ This case is documented to emphasize on need of proper dental autopsy which includes evidence collection from the site of crime and the deceased, meticulous analysis and recording the findings of the evidence which can aid in further criminal investigation.

Case Report

A 75-year-old female was found murdered in her house, her face was brutally dismembered with injuries sustained to the dentition. A medical

autopsy was performed to determine the cause of death. Later dental autopsy was performed to aid in the ongoing murder investigation. Thorough dental examination was performed, intraoral photographs were obtained, impressions of upper and lower arches were taken using irreversible hydrocolloid material and radiographs were obtained of certain teeth specimen. The findings of the dental examination were as follows:

1. Generalized extrinsic stains most likely to be tobacco stains
2. Generalized attrition of all the teeth
3. Teeth 1-7, 1-6, 1-4, 2-5, 3-5 and 4-5 were root stumps
4. Teeth 1-5, 1-3, 1-2, 1-1, 2-1, 2-3, 3-4, 3-3, 3-1, 4-3, 4-4 displayed Grade I tooth mobility.
5. Teeth 1-5, 3-3, 3-4, 4-4, 4-6 showed cervical abrasion.
6. Laceration was noted along alveolar ridge in relation to 3-5 to 3-6. (Black arrow)
7. During the postmortem examination teeth 3-7 and 4-1 were luxated probably due to inflicted trauma and were hanging into

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their respective sockets by mere soft tissue tag attachment. These teeth subsequently exfoliated during the oral cavity examination. The tooth 4-1 appeared to be intact with no evidence of traumatic fracture. The tooth 3-7 appeared to be fractured obliquely at the level of cervical third of the root.

8. Although the teeth 1-6, 2-8, 3-2, 4-2, 4-7 and 4-8 were missing in the oral cavity at the time of postmortem dental examination, it was observed that the alveolar mucosa in relation to these teeth appeared to be completely intact with no evidence of fresh wounds/injury at these sites suggesting extraction/exfoliation of these teeth at least 4 weeks prior to the day of examination. A better time estimate could have been possible with radiographic examination, facilities for which were however not available in the

mortuary. The alveolar mucosa in relation to the teeth 3-6 and 3-7 showed breach in the integrity indicating an unhealed socket wound suggesting a recent tooth extraction or traumatic avulsion or exfoliation of the tooth.

A few days later the local police officials recovered 3 teeth like fragments from the crime scene. The questions which remained unanswered before the authorities were: Are the recovered fragments part of human dentition? Do the teeth fragment recovered match with the victims missing teeth? Or is there any other victim?

Examination of the Evidence (tooth fragments recovered from the crime site)

The description of the morphological features of the teeth like fragments is included in the table:

Table 1: Morphological features of teeth fragments recovered from the crime scene

Morphological features of Tooth Fragment #1	
Buccal Aspect	(a) Fracture line is seen extending obliquely downward starting 2.5 mm mesial and apical to the mesiobuccal cusp tip and running across the buccal surface of the tooth crossing the cervical line at the junction of middle and distal thirds of the buccal surface and extending up to the level of middle of the middle third of the distal root.
Mesial Aspect	(b) The distal root shows a slight distal inclination in relation to the crown.
	(a) Mesial root is missing being fractured from the main body of the tooth.
	(b) A single pulp canal is noted on the sliced portion of the distal root.
	(c) The height of contour of the buccal and the lingual surface is normal and observed at a level proportional to the degree of attrition.
Lingual Aspect	(d) The fracture line is noted beginning at the occlusal surface involving the mesiolingual and mesiobuccal cusp of the mesial side. The fracture line descends inferiorly in oblique fashion towards the middle of the middle third portion of the distal root. The fractured mesial surface of the distal root showed bright red blood clot within the pulp canal. The margins of the fracture line appear to be sharp.
	(a) Fracture line is seen extending 2 mm distal and apical to the mesiolingual cusp tip running in an inferior and oblique direction up to the middle of the middle third of mesial surface of the distal root.
Distal Aspect	(b) The lingual developmental groove demarcates the mesiolingual and distolingual cusps.
	(a) Crown length is shorter distally than mesially hence a greater portion of the occlusal surface is seen from this aspect.
Occlusal Aspect	(b) The height of contour of the buccal and the lingual surface is normal and observed at a level proportional to the degree of attrition.
	(a) Three complete cusps (distobuccal, and distal on the buccal aspect and distolingual on the lingual aspect) and two partial cusps (mesiobuccal on the buccal aspect and mesiolingual on the lingual aspect) cusps are present.
	(b) The fracture line extends 2 mm mesial to mesiobuccal cusp tip up to the central groove at a point directly opposite the mesiobuccal cusp tip and extending obliquely and distolingually to a point 2 mm distal to the expected mesiolingual cusp tip location (diametrically opposite the mesiobuccal cusp tip).
Root	(c) There is Grade II attrition of the occlusal surface.
	Single slender root with a mild curve and extending from the distal half is noted. The apex is closed and intact.

(Contd.)

Morphological features of Tooth Fragment #2	
Buccal Aspect	(a) A part of the mesial one-third of the mesiobuccal portion of the crown is seen occluso-cervically. (b) The fracture line is seen to be extending from the junction of occlusal and middle one-third along the mesiobuccal line angle and extending down in an oblique manner and distally till the interradicular bifurcation area. (c) The margins are sharp at the site of the fracture line. (d) Cervical line on the buccal aspect is not clearly visible due to the debris present. (e) Mild concavity of the mesial outline is visible from the buccal aspect at the cervical one third.
Mesial Aspect	(a) The lingual cusp tip is visible and appears at a higher level than the buccal aspect of the tooth fragment. (b) Mesial marginal ridge cannot be appreciated due to fracture. (c) Developmental depression is seen between the buccal and lingual aspect of mesial root extending from the cervical constriction up to the apex. (d) Root apex appears to be bluntly tapered.
Lingual Aspect	(a) The mesiolingual portion of the cusp is evident with a fracture line extending from the tip of the mesiolingual cusp downwards in oblique fashion till the inter-radicular furcation area. (b) A single slender root is present with fracture of the apical third portion of the root.
Distal Aspect	(a) When viewed from distal aspect of the tooth fragment, pulp cavity is seen with two occlusal extensions; i.e. pulp horns (buccal and lingual). (b) Apex shows two openings of the apical pulp canals.
Occlusal Aspect	The occlusal morphology cannot be appreciated due to fracture.
Morphological features of Tooth Fragment #3	
Buccal Aspect	(a) The broader surface of the crown bearing the cusp is labeled as buccal aspect. (b) The mesial cusp ridge is higher than the distal cusp ridge.
Mesial Aspect	(a) Two well-defined cusps are present with their cusps tips at the same height. (b) The buccal cusp tip is placed centrally over the crown and the buccal surface of the crown has a lingual offset and hence it is highly suggestive to be a mandibular premolar. (c) The fracture line is seen running downwards obliquely from the cervicoenamel junction on buccal aspect up to the junction of cervical third and middle third of the root on the lingual aspect.
Lingual Aspect	(a) This surface is spheroidal. (b) No developmental grooves noted. (c) Part of the buccal portion of the occlusal surface is seen from this aspect due to shorter lingual cusp.
Root	Single pulp canal is present on the exposed fractured surface of the root. The margins of the fracture lines are sharp

Radiographic Findings

Dental radiographs of the three tooth like fragments (tooth fragment #1, #2 and #3) handed over by the Police taken. Also a dental radiograph of tooth #3-7 was obtained which dislodged during the postmortem dental examination. On radiographic examination, the general shape, size and outline of these structures appeared to be in conformity of the appropriate tooth. The degree of radiopacity of enamel wherever it was observed and the radiopacity of the dentin were in conformity of the expected radiopacities of these structures. The radiolucent pulp canal space was observed in its appropriate location and considering the deceased

person's age it showed severe narrowing of the lumen space on the radiograph. Thus the morphologic and radiographic examination confirmed that these above-mentioned tooth like fragments to be indeed human teeth.

Approximation of Fractured Fragments #1 and #2

The combined dimensions of the approximated tooth fragments (occluso-apical length) was 20 mm

Crown: Mesiodistal width: 9.5 mm, Buccolingual width: 11 mm, Cervicoocclusal length: 8 mm (on lingual aspect) and 6 mm (on buccal aspect)

Root: Length: 7.5 mm (mesial root) and 11 mm (distal root). Apical third of mesial root fragment is possibly

embedded in the alveolar socket and should have been confirmed with a radiograph, the facilities for which were, however, not available. Buccolingual width of mesial root at level of cervical third: 6 mm, Buccolingual width of mesial root at level of apical third: 3.5 mm, Buccolingual width of distal root at level of cervical third: 5 mm and Buccolingual width of distal root at level of apex: 3 mm

On approximation of the fractured tooth fragments #1 and #2 it was seen that the fractured portions on articulation with each other approximated well at the corresponding fracture lines on all aspects. On approximation, the tooth was identified to be permanent mandibular molar due to the following reasons:

- a. Occlusal outline when viewed from occlusal aspect is roughly hexagonal in shape.
- b. Presence of two roots (mesial and distal root), each having a distal tilt in the apical third portion.
- c. Two adjacent cusps were found to be at lower level than the two opposing cusps due to a peculiar pattern of attrition. Hence the two adjacent cusps with more attrition than the opposing cusps were identified to be as the functional cusps and was thus labeled as the buccal side.

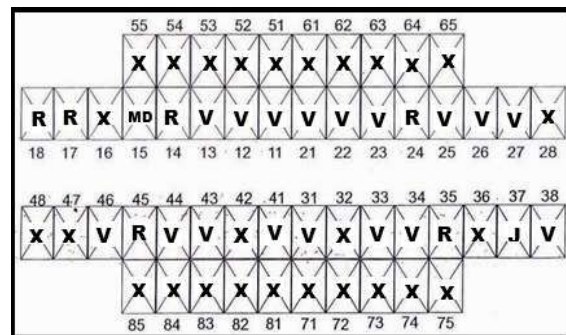
On examination of the following anatomic characteristics after approximation tooth fragments #1 and #2, the tooth was identified to be permanent left mandibular first molar.

- a. The approximated tooth appears to be trapezoidal in shape from the buccal aspect. The mesial root is curved mesially from a point shortly below the cervical portion to the middle third of the root and from this point up to the fractured portion of the apical third it curves distally.
- b. Distal root is less curved than the mesial root and its axis is in the distal direction from the cervical portion up to the apex. Root shows

mild curvature in distal direction in the apical third. Both roots are wider mesiodistally. Developmental grooves on the root cannot be appreciated.

- c. On the lingual aspect, lingual developmental groove is present as a line of demarcation between the lingual cusps, extending downwards from the occlusal aspect up to the occlusal third of the crown.
- d. Mesial surface of the mesial root is convex at the buccal and lingual borders.

All the above anatomic characteristics are suggestive that the two fractured tooth fragments (#1 and #2) are of the same tooth which is identified to be a permanent mandibular left first molar.



Primary codes	Secondary codes
B - Primary tooth	A - Anomaly/ any pathology
C - Crown	Dental Treatment Carried Out
D -Distal	D - Decay
F - Facial/labial/buccal	E - Endodontically treated teeth
I - Impacted	G - Gold, cast metal
J - Fractured tooth	K - Stainless steel crown
L - Lingual	N - Non-metallic restoration
M - Mesial	P - Pontic
O - Occlusal/incisal	R - Root TIP
V - Virgin tooth	S - Silver amalgam
X - Missing tooth	T - Removable prosthesis
	Z - Restoration

Fig. 1: Record of intraoral examination.

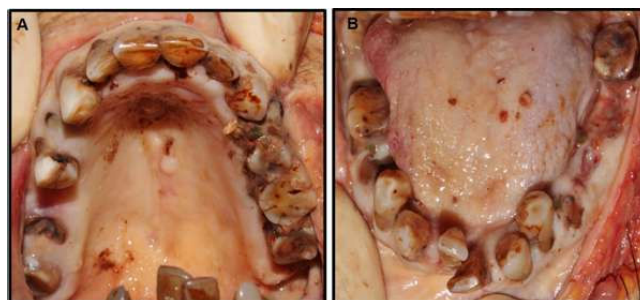


Fig. 2A,B: Photographs of maxillary and mandibular arch respectively.

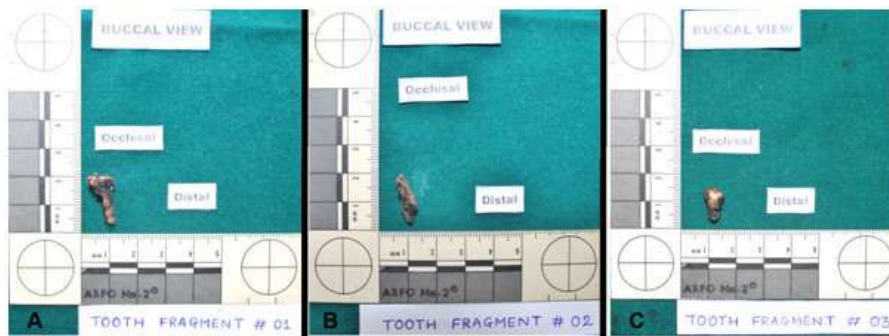


Fig. 3A: Tooth fragment #1 recovered from the crime scene.

Fig. 3B: Tooth fragment #2 recovered from the crime scene.

Fig. 3C: Tooth fragment #3 recovered from the crime scene.

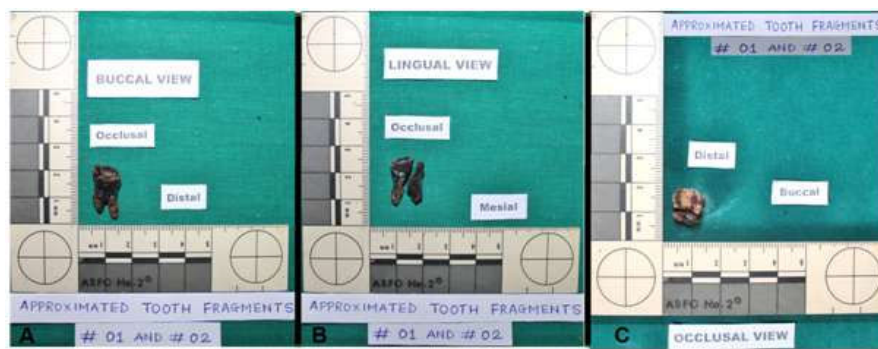


Fig. 4A: Buccal view of approximation of tooth fragment #1 and 2.

Fig. 4B: Lingual view of approximation of tooth fragment #1 and 2.

Fig. 4C: Occlusal view of approximation of tooth fragment #1 and 2.

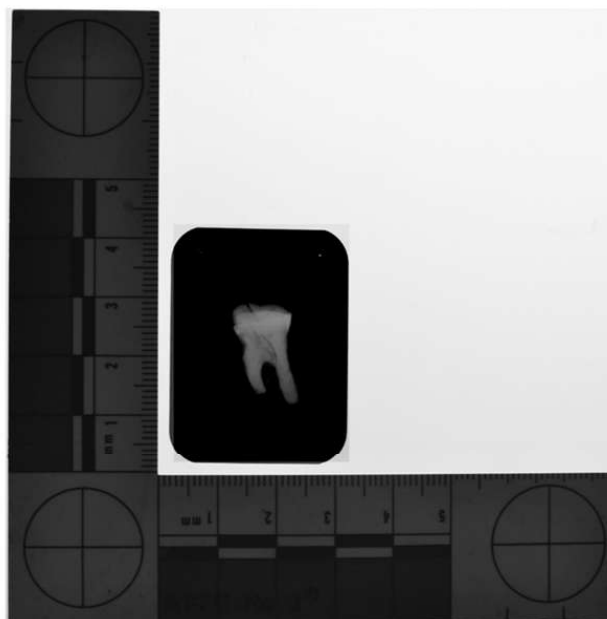


Fig. 5: Radiograph of approximated tooth fragments 1 and 2.

Summary

The alveolar mucosa in the region of tooth #3-6 showed breach in continuity and was therefore suggestive of a very recent extraction or traumatic avulsion or exfoliation of the tooth. Tooth #3-7 was loosely attached by soft tissue and was observed to be fractured at the root portion during the time of postmortem dental examination. The remaining portion of the root may or may not be present in the alveolar socket of the deceased person and there were no adequate radiographic facilities at the place of examination to prove the same. The teeth fragments recovered from the crime site show the same extent of attrition and tobacco stains as the other teeth of the victim. The general size of the teeth appear similar to each other when compared to the tooth on the contralateral side

Approximation of the tooth fragments #1 and #2 helped to conclude that this tooth was the permanent left mandibular first molar. The probability that such perfect match can be obtained from broken pieces of teeth from two different individuals is very minuscule and therefore it is concluded that the two fragments belong to the same tooth of the same individual. Tooth fragment #3 was identified to be the left mandibular second premolar. On examination a root stump was seen in the oral cavity and also in the mandibular cast in the region of #3-5. It could not be articulated on the cast as the fractured margins of the said tooth may extend below the soft tissue-gingiva in the mouth and it is beyond the scope of replication on the cast. Hence the conclusion that the tooth fragment #3 belongs to the deceased person cannot be made only on clinical examination especially in the absence of a dental radiograph of this region. All of these points are conclusive to provide a positive match.

Discussion

Keiser-Neilson defined forensic dentistry as "that branch of forensic science that in the interest of justice deals with the proper handling, examination of dental evidence and the proper evaluation and presentation of dental findings".² Forensic dental evidence is one of the keystones of person identification. The role of dental evidence and forensic dentists in person identification in mass disasters has been reported frequently in the literature.³⁻⁶

Forensic dental identification can either be carried out as a comparative identification in

which the postmortem dental data of the deceased individual is compared to the antemortem dental documents and radiographs. Comparative dental identification is the most preferred method as it scientific and cost-effective method.⁷ However, sometimes ante mortem records are not available or the antemortem dental records may be of poor quality such that there is inability to establish identification. In the postmortem dental autopsy, all the teeth may not be recovered as a result of postmortem trauma.⁷ In such situations a complete dental profiling is performed by the investigating dental forensic specialist and this data is used by the law authorities to narrow down the search in the investigation.¹ In some victims or deceased individuals there can be absence of dental restorations, then the forensic dentists rely on morphological traits for comparisons.⁸ Some of the important traits to record are type of dentition (permanent or deciduous or mixed), size, shape, color, occlusal outline, position in the dental arch, caries, root shape/size/number/curvature, cusp pattern, composite and metal fillings, prosthetics, teeth fractures, bone trabecular patterns, pulpal morphology and stones, supernumerary teeth, etc.^{1,7,9} Despite these challenges, teeth and dental traits are recognized as one of the most valuable individualizing features of the human body.⁷

To conclude, in this particular case, dental autopsy was performed to assess orofacial injuries of the deceased individual. Evidence in the form of tooth fragments were produced for examination on a later date. This highlights that adequate evidence collection is of paramount importance. Evidence collection must include detailed dental profiling with a note on description of any wounds, trauma or injuries. This data must be supplemented by appropriate photographs with a scale sans perspective distortion, replication of the dentition in plaster models and obtaining radiographs if any. Forensic dentist must have adequate records to be able to study and effectively correlate any possible evidence produced on a later date.

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