



# Bite Mark Analysis

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## ABSTRACT

Bite mark analysis plays an important role in personal identification in forensic odontology. They are commonly seen in violent crimes such as sexual assaults, homicides, child abuse, etc. Human bites are common on the face and are usually seen on prominent locations of the face such as the ears, nose and lips. Individual characteristics recorded in the bite marks such as fractures, rotations, attrition, and congenital malformations are helpful in identifying the individual who caused it. We are reporting the case of a 55-year-old lady with bite marks on her left ear, who was allegedly assaulted by the suspect. On the basis of characteristic features of the suspect's dentition, it was concluded that the bite marks seen on the victim was most probably caused by the suspect.

**Keywords:** Bite mark, Teeth, Human bite, Dental casts, Photographic images.

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## INTRODUCTION

A bite mark has been defined as 'a pattern produced by human or animal dentitions and associated structures in any substance capable of being marked by these means'.<sup>1</sup> Human bites are common on the face with the frequency second to that of the upper extremity; and are usually seen on prominent locations of the face such as the ears, nose and lips.<sup>2</sup> In violent assaults consisting of more than one bite, it will be difficult to identify the bites. Lacerations, abrasions contusions/bruises, petechiae, indentations, erythema and punctures are the common forms of injuries that are observed with the bite marks.<sup>3</sup> Human bite mark can be described as an elliptical or circular injury that records the specific characteristics of the teeth and may be composed of two U-shaped arches that are separated at their bases by an

open space.<sup>4</sup> Bite marks may be the only physical evidence available in some of the most serious crimes especially in the late presenting victim. Human bite marks can be seen in cases of homicide, suicide, sexual assault, child abuse, etc.<sup>5</sup> Since, these crimes are serious in nature, it is very important to record, document and describe the injuries carefully. After confirming the injury as a bite mark, comparison with the suspect's dental records can be initiated. The essential idea is that an image of the incisal edges of the suspect's teeth is superimposed on an image of the bite mark, and then it can be seen whether the images 'match' or 'fit'.<sup>6</sup>

## CASE REPORT

A 55-year-old lady (victim), who was sexually assaulted, was brought by the police along with a 22-year-old male (suspect) to the department of oral pathology and microbiology, Government Dental College, Thiruvananthapuram on 13th August 2012. The victim was not able to recall any details regarding the suspect nor were there any eye witnesses to this incident. The investigators had drawn a blank on all fronts but for one vital piece of evidence—the bite marks on the victim's body. On examination of the victim, semicircular bruising patterns, the purported bite marks, were observed on the left cheek and left ear. These were photographed using Canon Powershot SX 120 and impressions were made using addition silicon light body impression material with a backing of plaster of Paris for suitable support of the impression. The impressions were then washed and dried and they were poured in dental stone to obtain cast. They were then compared with the suspect's dentition using a commercially available software program, Adobe Photoshop 7.0.1 by a forensic odontologist.

## DISCUSSION

The bite marks on the images revealed patterns that corresponded with those caused by the anterior teeth of the upper human jaw. Such a determination was made based on the relative size of teeth particularly the wider central incisor and narrower lateral incisor visible on the bite mark.<sup>7</sup> The color of the bite mark was mainly dark red/dark brown, while in a few photographs it was a lighter shade of brown and greyish brown owing perhaps to healing lacerated wounds. The bite mark measured approximately 3 × 1 cm.

It was noted that the mark corresponding to the upper right central incisor was at an angle to the upper right lateral

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incisor (Figs 1A and B) which was different to what is typically expected. Also, the marks corresponding to the upper lateral incisors revealed a rhomboidal or diamond shape (Figs 2A and B). This indicated that the teeth that caused the bite mark had certain unconventional characteristics and could be compared to each other.<sup>8</sup>

The images of the dental casts of the suspect's teeth revealed a generally U-shaped dental arch (Fig. 3A). All teeth, except the upper left third molar, were present in the suspect's mouth. The teeth revealed generalized attrition, with a greater degree of attrition on the premolar and molar teeth. An angulation of the biting surface of the upper right central incisor relative to the lateral incisor was also noticed.

The images revealed attrition, stains, signs of inflamed gingiva and gingival recession. The images also showed fracture on the biting surface of the maxillary and mandibular central incisors. In particular, the distoincisor angle of maxillary central incisor had a pronounced fracture (Fig. 3B). In addition, a relatively uncharacteristic cusp-like (triangular) appearance on the biting surface of the maxillary lateral incisors was also seen.

**COMPARISON PROCEDURE**

Scanned images of one of the dental cast were imported into a commercially available software program (Adobe Photoshop 7.0.1) on a desktop computer. In the software, the biting surfaces of the maxillary incisor teeth were traced semiautomatically (using the 'Magic Wand' tool, at a tolerance level ranging between 4 and 12). The conversion of the image to Life Size enabled a 1:1 (Life Size) superimposition (on the computer) of the biting surfaces and its comparison with the bite mark.

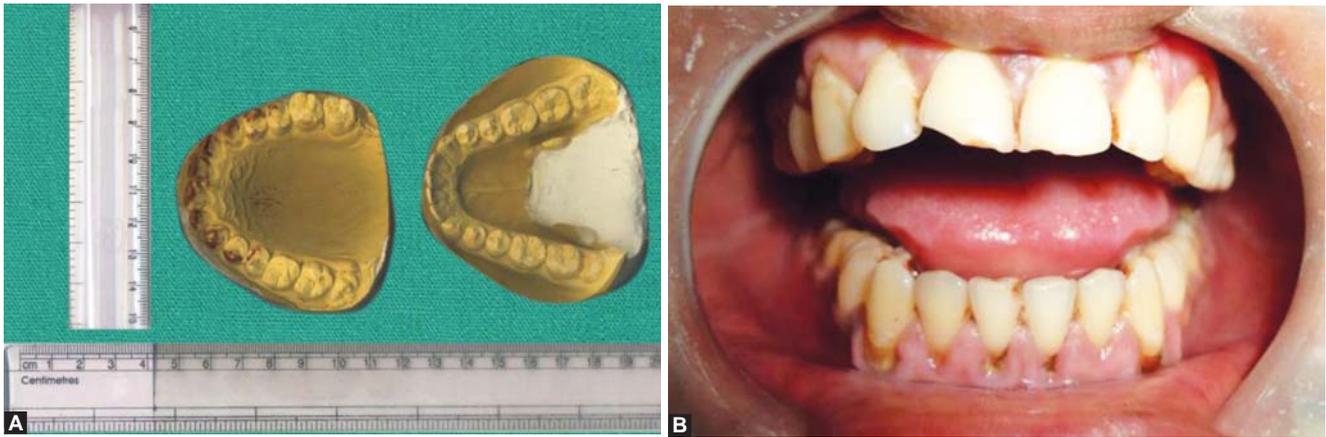
Superimposition of the traced biting surfaces onto the bite mark on image revealed concordance in terms of general alignment of the four incisor tooth marks; a concordance was also appreciated of the relative angulation of marks of the right incisors on the image with the biting surfaces of the corresponding teeth on the suspect's dental cast. A relatively 'unequivocal fit' of the biting surfaces and the bite mark was appreciated. Furthermore, the relative angulation of the upper right incisors on the suspect's dental casts and on the bite mark of the victim was congruent.



**Figs 1A and B:** The relative angulation of the bite marks caused by central and lateral incisors is depicted by the black lines



**Figs 2A and B:** The biting surfaces digitally traced on the incisor teeth (black outline) on the cast of the suspect's upper jaw. Note the 'rhomboidal' shape of the lateral incisor's marks, especially the right lateral incisor



**Figs 3A and B:** Scanned dental casts of the suspect's upper and lower jaws. The image of suspect's teeth revealing some of the findings in the mouth, including the sharp biting surfaces of the maxillary lateral incisors, attrition, stains, signs of inflamed gingiva and gingival recession

The comparison shows that there is a concordance in terms of general alignment of the bite mark caused by the maxillary incisor teeth of suspect's dental cast with the bite marks visible on image. The comparison also reveals concordance in relation to the relative angulation of the upper right incisors on the bite mark image and the biting surfaces of the corresponding teeth on the suspect's dental cast. Furthermore, the 'rhomboidal' shape of the upper lateral incisors' marks correspond with the cusp-like anatomy of the biting surfaces of the upper second incisors seen on the images of the suspect's dental cast and photographs of the teeth. An unambiguous conclusion on the certainty of the bite marks being produced by the suspect's teeth is based largely on a number of unconventional/individual characteristics visible in the comparison process, such as tooth shape, the angulation of biting surfaces of teeth to each other and spacing between teeth. In the present case, there are two such characteristics in relation to the upper right incisor teeth; the relative angulation of the central incisor and the 'rhomboidal' shape of the lateral incisor. Therefore, the bite mark on the left ear of the victim shows some degree of specificity to the suspect's teeth by virtue of a few concordant points, including two unconventional/individual characteristics. Hence, the assumption that the teeth of the suspect probably caused the bite marks on the left ear of the victim.

## CONCLUSION

The bite marks inflicted on the victim can be used as an effective aid in providing clues regarding the suspect in some of the most serious crimes. The uniqueness of bite marks due to specific characteristics and arrangement of the teeth such as fractures, rotations, attritional wear, and congenital malformations will be helpful in identifying the individual who caused it. In the present case, two such characteristics of bite marks-the relative angulation of the maxillary right

central incisor and the 'rhomboidal' shape of the maxillary right lateral incisor-led to the conclusion that the teeth of the suspect probably caused the bite mark on the left ear of the victim.

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