WOUNDING DYNAMICS IN DISTORTED BITEMARKS: TWO CASE REPORTS

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ABSTRACT

An essential factor involved in distortion of bitemarks on the skin is the dynamics of biting related to the location on the body. This study describes the comparison between the identification of bitemarks left on different regions of the victims' bodies in two homicide cases. The findings indicated that a stepwise dynamic comparison of serial adjacent marks with a part of the dentition in consideration of movement of the jaws and distortion of the skin was useful in identifying matching points. The identification process indicated possible wounding dynamics of biting. **(J Forensic Odontostomatol 2000; 18:46-51)**

Keywords: Forensic odontology, identification, bitemark dynamics, distortion

INTRODUCTION

A bitemark left on the victim is important evidence for identification of the assailant.[1-5] When bitemarks are not distorted, two dimensional comparison with dentitions will be useful to establish similarities and differences.[6-8] However, various distortions can be caused by the dynamics of biting particularly taking into account the location of the bite (dynamic distortion), artefacts and photographic documentation.[9-11] A simple superimposition procedure is usually insufficient to obtain a convincing result and various other methods for bitemark analysis have been reported.[12-22] An idea for the identification of bitemarks with a possible distortion may be a stepwise dynamic comparison of serial adjacent marks with a part of the dentition in consideration of movement of the jaws and distortion of the skin. The identification process can consequently be used to interpret the dynamics of biting (wounding dynamics). It may be also useful for identification of bitemarks with another kind of distortion such as photographic distortion. The concept of dynamic wounding and its analysis in bite injury has become of interest in forensic pathology,[7,10] and this study describes the identification of bitemarks left on different locations of the bodies of victims in two homicide cases, suggesting the possible wounding process.

METHODS OF BITEMARK IDENTIFICATION

Photographs: In the present cases, the photographs of bitemarks with a two-dimensional scale used for identification were taken using normal flashlight by the police officers during autopsy and printed as usual. The scaled bitemark photographs were scanned and stored in a personal computer.[23]

Superimposition: Dental casts were fabricated from the suspected assailants and also from the victim in Case 1. The occlusal surfaces of all dental casts were then pressed onto the flat surface of a plate of clay and the outlines highlighted in black ink to simulate bitemarks.[18,23] This technique provides more precise marks than direct inking of occlusal surfaces on casts, particularly considering the three-dimensional alignment of teeth. The marks were then scanned and stored in a personal computer. Superimposition for comparisons of the dentitions with the bitemarks was performed by computer and appropriate graphics software Adobe(R) Photoshop 4.0 J.*[18]

* Adobe Systems Incorporated, Mountain View, CA

Wounding Dynamics: Often during biting of a human victim the movement of the jaws and the mobility of the bitten tissues leads to distortion. This needs to be taken into consideration when matching a dentition to a bitemark and the phenomenon may be labelled wounding dynamics.

Stepwise Dynamic Comparison: This procedure is an attempt to follow the extent and direction of the bitemark distortion by identifying it and by superimposing in a stepwise or serial fashion the suspected biting dentition. Matchings come to light which, if the dentition's characteristics are unique, are reliable enough to be positive.

CASE REPORTS

Case 1

Case history

A 49 year-old female victim was found dead after a fire at her home. The immediate cause of death was carbon monoxide poisoning, possibly contributed partially by protracted asphyxia from strangulation. Two bite injuries were identified at autopsy:

a) A spindle-shaped contusion (5.5x8 cm) with arching alignment of some small triangular and rectangular abrasions (0.5x0.9 cm) on the lateral surface of the right upper arm (Fig. 1a).

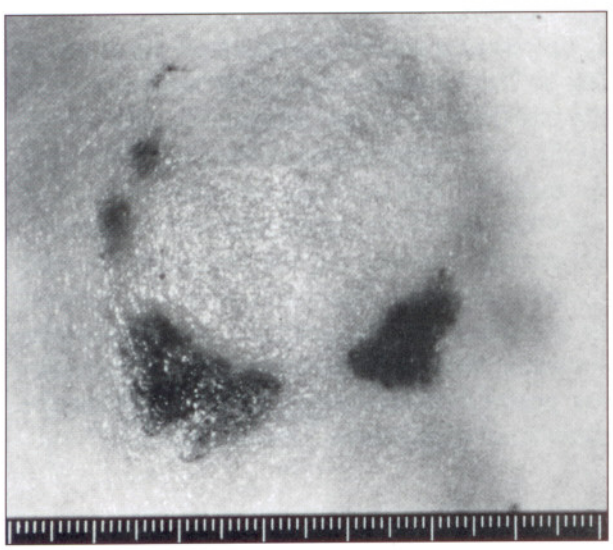

Fig.1(a): Bitemark in Case 1 (right upper arm)

b) An elliptical contusion (6x4.5 cm) surrounded by some small arching abrasions (0.5x2.5 cm) on the anterior surface of the left knee joint (Fig. 1b).

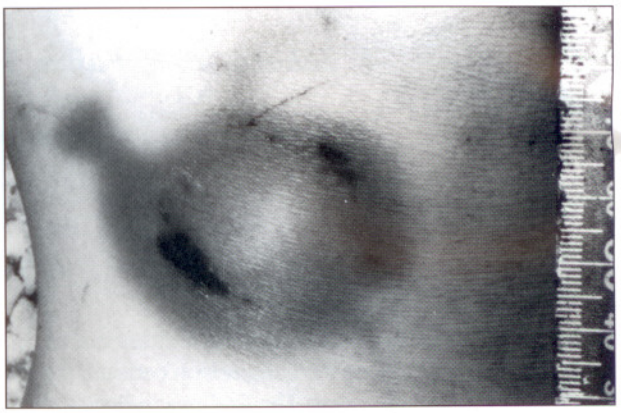

Fig.1b: Bitemark in Case 1 (left knee joint)

Bitemark analysis

Dental casts were fabricated from the suspected assailant, a 44 year-old female, and from the victim at autopsy because of the possibility of self-infliction of the knee joint bite and possible retaliatory bitemarks on the assailant. Comparisons of the dentitions with the bitemarks suggested characteristic similarities of the shape, size and alignment of the mandibular left lateral incisor, canine and 1st premolar with the bitemarks on the lateral surface of the right upper arm and of the mandibular left lateral incisor, canine and the maxillary central incisors of the suspect. Further bitemark analysis was performed using stepwise dynamic comparisons of serial adjacent marks with a part of the dentition and likely movement of the jaws concerned taking into consideration distortion of the skin (wounding dynamics) as described below. Only the suspect's dentition matched the marks at every point.

a) Bitemarks in the right upper arm (See Figs. 1, 2 and 3)

Step 1. When a cast of the mandibular left lateral incisor, canine and 1st premolar was superimposed over the middle part of bitemarks and moved obliquely upward, the labial and lingual margins matched the contours of the marks (Fig. 2a).

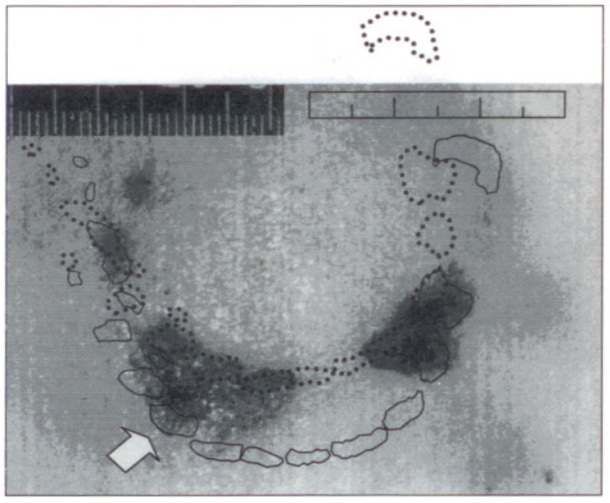

Fig.2a: *Comparison of the suspect's dentition with bitemarks in the right upper arm of Case 1 (overlay of the mandibular left lateral incisor, canine and premolar)*

Step 2. The right side bitemarks in the photograph were compared with the right part of the mandibular dentition. When impressions of the mandibular right canine and 1st premolar were overlaid and shifted obliquely upward, the labial and lingual margins matched the bitemark contours (Fig. 2b).

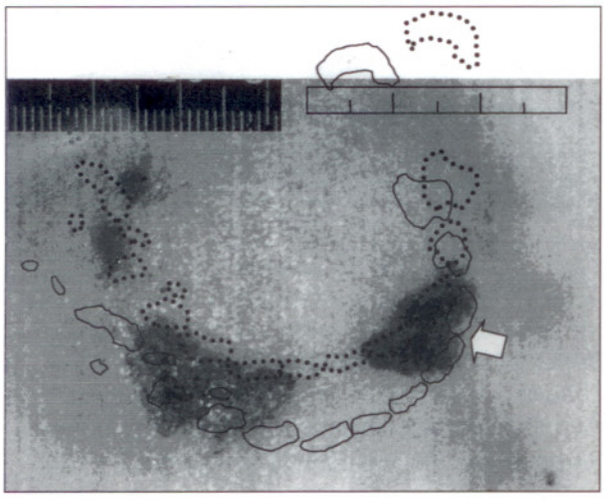

Fig.2b: *Comparison of the suspect's dentition with bitemarks in the right upper arm of Case 1 (overlay of right lateral incisor and canine on the bitemarks. Matching points are shown with arrows [wounding dynamics demonstrated by shift between dotted and solid lines])*

In the terminal position, the lingual margins of the left lateral incisor, canine and 1st premolar were located somewhat upward to be seen in Fig. 2b, well in parallel with the middle part of the bitemark contours, suggesting a skin surface upward distortion which thus enabled confirmation of the identity.

Step 3. When the left upper side bitemarks in the photograph were compared with the mandibular left 2nd premolar and 1st molar, a good match was obtained by a clockwise rotation of the dentition. In this case, the initial position of the left 2nd premolar coincided well with the terminal position in Step 2.

In conclusion, the bitemarks were considered to be made by the mandibular dentition, accompanied by a considerable dynamic distortion. Initially the left lateral incisor, canine and 1st premolar pressed upward, abrading and distorting the skin, causing the middle part of the bitemarks, followed by the penetrations of the right canine, 1st premolar, left 2nd premolar and 1st molar from both sides.

The process was repeated for the bitemarks in the right upper arm and left knee joint using axial and rotatory shifting, which started at the anterior teeth (incisors and canines) and finished at the molars (Figs. 2a, 2b and 3).

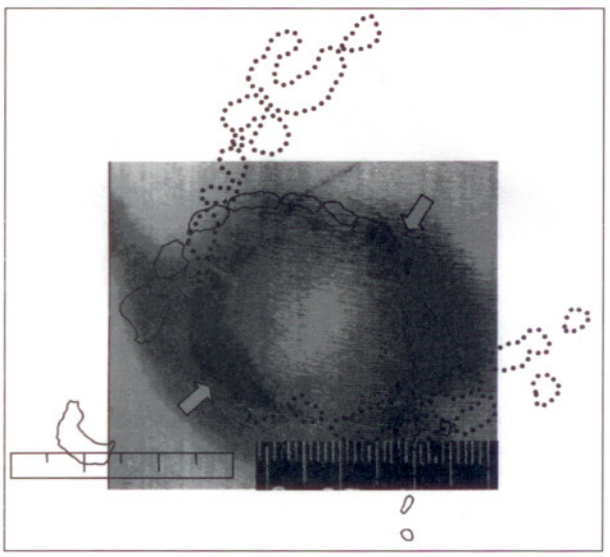

Fig.3: *Comparison of the suspect's dentition with the bitemarks in the left knee joint of Case 1. Overlay of the upper (dotted line) and lower (solid line) anterior teeth on the bitemarks. Matching points are shown with arrows*

b) Bitemarks in the left knee joint

The upper and lower bitemarks coincided with the impressions of the mandibular left lateral incisor and canine and the maxillary central incisors, respectively, as follows:

Step 1. The maxillary central incisors were superimposed over the lower bitemarks. An upward movement of the teeth on the round patellar surface could well explain a slightly upward distortion of the lateral parts of the bitemarks (Fig. 3). A slight abrasion was identified at the location of the right canine in the terminal biting position.

Step 2. When the mandibular left lateral incisor and canine were compared with the upper bitemarks, a good match was obtained by a rotatory shifting. An additional tracking mark of the mandibular right lateral incisor was observed proximally to the bitemarks (Fig. 3).

In conclusion, the bitemarks were considered to be made by the upward and downward movements of the maxillary and mandibular dentitions, respectively. Dynamic distortion of the bitemarks was markedly smaller at the knee joint than at the upper arm.

Case 2

Case history

A 46 year-old female victim was found dead in the grounds of a shrine. The cause of death was asphyxiation from manual strangulation and/or smothering. Three typical bite injuries of a similar size were identified on the upper abdomen: circular bruises (4-5 cm in diameter) with small, pale, rectangular impressions (0.2x0.5 cm-0.5x0.8 cm) (Fig. 4).

Bitemark analysis

Dental casts were fabricated from a 44 year-old male suspect. Superimposing the dental impressions over the bitemarks was performed as before in Case 1 and the suspect's dental casts matched the bitemarks at every point (Fig. 5).

The images of the dental impressions were dynamically compared with three bitemarks, which were located a) left-side, b) right-side and c) middle on the upper abdomen, by axial and rotatory shifting in a similar way as described above. Only minor dynamic distortion was observed in all three bitemarks.

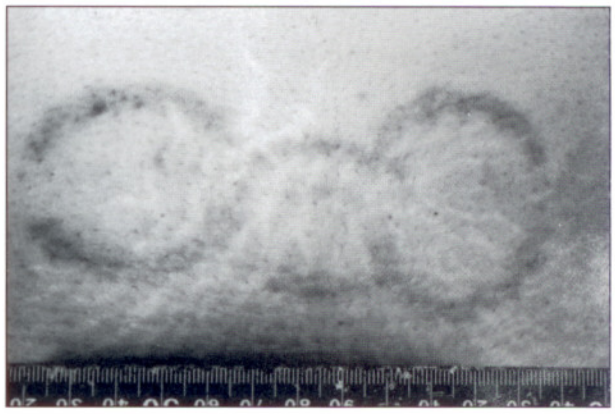

Fig.4: *Photographs of the bitemarks in Case 2*

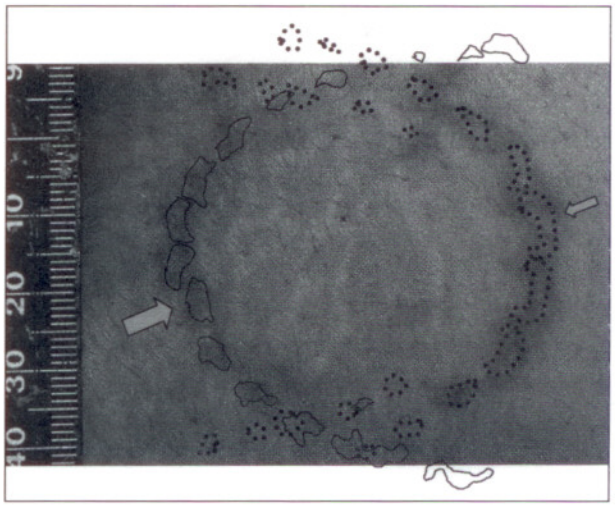

Fig.5: *Comparison of the dentition with the bitemarks in Case 2: the suspect's clay impression images matched the marks at every point (arrows) [dotted line, upper dentition; solid line, lower dentition]*

a) The left-side bitemarks

Step 1. The maxillary incisors and canines showed a good matching with the upper bitemarks by simple superimposition (Fig. 5).

Step 2. The mandibular incisors and canines also matched the lower bitemarks, and the slightly upward shift gave a good match of the right premolars.

In conclusion, the upper and lower bitemarks coincided well with the clay images of the maxillary and mandibular anterior teeth, respectively.

b) The right-side bitemarks

Step 1. The maxillary incisors showed a good matching with the upper bitemarks, and a small rotatory shift gave a match of the canines and molars.

Step 2. The mandibular incisors showed a good match with the lower bitemarks, and the canines and molars matched well after a small rotatory shift.

In conclusion, the bitemarks coincided well with the clay images of the maxillary and mandibular teeth.

c) The middle bitemarks

Characteristics of the bitemarks were not so clear as the others. No mismatching points were found by dynamic comparison with the dental impressions images.

DISCUSSION

Bitemarks on victims are usually distorted to some extent as a result of the curvature and elasticity of human skin, which mainly depends on the anatomical location and contribution of tissue composition and underlying structures. Further distortion can be caused by the dynamics of biting related to the body region, physical position of the victim, fighting or struggling, biting direction and force. This kind of distortion due to wounding process is of a great interest in forensic pathology. The shape of bitemarks may also be distorted by artefact and angles at photographic documentation. Although an exaggerated distortion may be produced when bitemarks are photographed from a markedly oblique angle,[11,23,24] this is rarely a problem where a characteristic shape of wound (bitemark) is recognizable. Minor photographic distortions do not greatly alter the view of individual dental clay impression images and alignment of adjacent teeth. The curvature of the body does not produce significant photographic distortion, and was not a problem in cases where the entire mark could be observed from one viewing angle.[10,11] Thus, it appears practical to compare a set of serial adjacent bitemarks with a part of the dentition in a stepwise dynamic comparison as a way of overcoming cases of considerable distortion especially due to the dynamics of biting.

In the present cases, convincing identification was possible using dynamic comparisons, although distortions of bitemarks due to curvature of the body surface and the dynamics of biting were observed to varying degrees. The distortion was minor in the knee (case 1) and also on the abdomen (case 2), whereas it was more marked in the upper arm (case 1). These observations supported previous studies that moderate tissue flexibility may cause a larger dynamic distortion than low and high flexibility.[5,11,23,25]

As mentioned above, a stepwise dynamic comparison of serial adjacent marks with a part of the dentition in consideration of movement of the jaws and distortion of the skin was useful to identify convincing matching points when marked distortion was suspected. The identification process indicated possible wounding dynamics of the bite.

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