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Two Bite Mark Cases with Inadequate Scale References

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ABSTRACT: Most literature addressing comparisons between epidermal bite marks and the perpetrator's bite pattern mandates fastidious coordination between the size of the compared reproductions. While ideal, this is not possible in every case and inability to control this variable in selected cases may not necessarily invalidate the comparison. The first case involves a known perpetrator. All photographic measurements were recorded with acceptable techniques to discover a serious discrepancy in arch size. The second case was degraded by the absence of a ruler in a tangentially made photograph of a bite mark. In both cases, the weight of the conclusions were lessened by these problems but the impartial handling of the evidence and explanation of discrepancies offered credibility to the analyses. Both cases illustrate that a technical infraction in processing and recording bite marks, though serious, need not automatically preempt the analysis.

KEYWORDS: odontology, bite marks, comparative analysis

The ability to discern the biter from the patterned injury he leaves in skin is a relatively new science, having made its first significant appearance in American courts in 1972 [*1*]. Closely scrutinized and often criticized during its period of scientific development [*2,3*], bite mark analysis, correctly performed, has emerged as credible evidence [*3,4*] and has been upheld by appelate decisions [*2,4-6*]. In perhaps the most compelling article on the legal implications of bite mark evidence, Hale [*2*] questions both the reliability of bite mark comparisons and the general acceptance of bite marks in the scientific community (Frye standard). Responding to these concerns, the American Board of Forensic Odontology (ABFO) has established formal guidelines[2] to aid in the handling of bite mark evidence and has held experimental workshops to evaluate the interpretive skills of participating forensic dentists. The document calls for protocol in the description and collection of bite mark evidence and specifies the use of scales and nondistorting techniques in photography so that resulting prints can reproduce the original size and shape of the injury. Several texts and articles elaborate the details of these photographic exercises [*1,7-13*].

Two cases are presented in which the size of the bite mark was unreliably recorded, making size-matching between the suspects' dental arch and victims' injury questionable. The legitimacy of proceeding with such evidence in light of its deviation from established norms is examined.

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[2]"Guidelines for Bite Mark Analysis," American Board of Forensic Odontology, 1984.

Case 1

A bite mark noted in the forearm of a 35-year-old white male homicide victim was processed by a forensic dentist following completion of the autopsy. The washed body, lying in the supine position, arms at its side was photographed. Appropriate photographs of the bite mark were made in color and black and white. Working photographs were made with the film plane parallel to both the mark and the ruler used for orientation. Dental impressions were made of the suspect and study models were poured. Shortly thereafter, the suspect confessed to having bitten and murdered the victim.

Figures 1, 2*a* and *b* show points of comparison between life-sized photographs of the bite mark and perpetrator's teeth. For each lacerated mark, there is a corresponding sharp, fractured tooth edge while contused marks conform to teeth with more rounded edges. A missing Tooth #10 appears as a non-injured space in the corresponding section of the bite mark. In summary, there is a perfect match on a tooth-to-mark comparison. However, when cellophane acetate tracings made from the study casts were overlayed onto the life-sized photograph of the bite mark, each arch was significantly smaller than its pattern in the bite mark (Fig. 3).

This case features a known perpetrator in which a size discrepancy between his dental arch

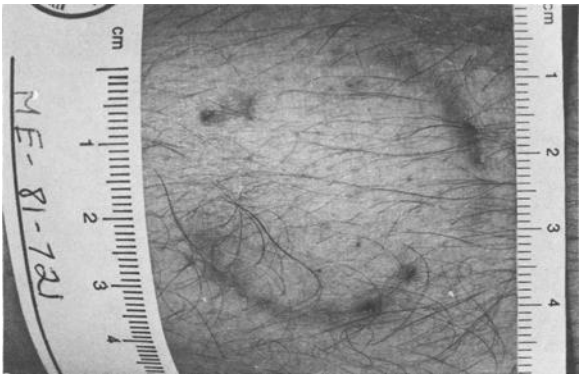

FIG. 1—*Life-sized (RR 1 : 1) photograph of bite mark showing maxillary arch on top. Note lacerations at top right, top left, and bottom right of picture. Remaining marks represent contusions.*

FIG. 2*a*—*Maxillary arch of perpetrator showing sharp edges of Teeth #7, 11, and 12 (patient's right lateral incisor, left cuspid, and first premolar).*

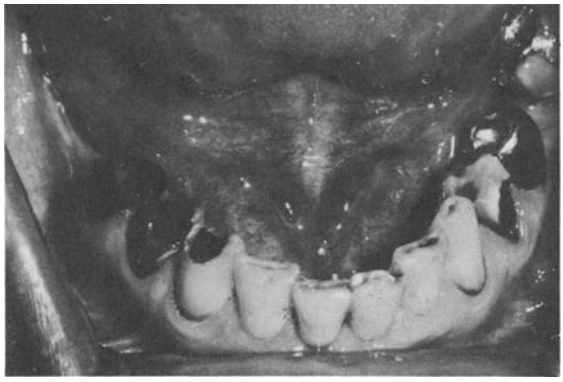

FIG. 2*b*-*Mandibular arch of perpetrator showing sharp dental edges of #26 and #27 (patient's right lateral incisor and cuspid).*

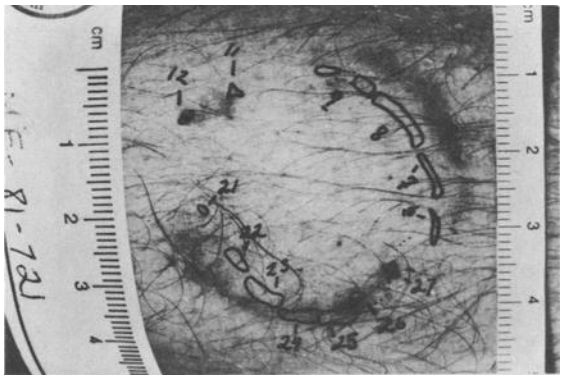

FIG. 3—*Superimposition of acetate tracings of perpetrator's anterior biting edges on corresponding areas of bite mark. Upper arch set at #11 and #12; lower arch set at #26 and #27.*

and the bite mark he produced was because of skin elasticity. The wound was apparently inflicted with the arm in flexion but photographed with the arm extended.

Case 2

A healing bite mark was noted in the abdomen of a 2-year-old white girl who died as a result of blunt cranio-facial trauma secondary to physical abuse. The lesion, severely distorted by superimposed recent surgical incisions, was not suitable for analysis. Color photographs made by police two days earlier when the child was admitted to the hospital in a coma, were recovered. They clearly showed a well inflicted human bite mark characterized by an unusual V-shaped maxillary arch and by six individual maxillary tooth marks indicating rotations of Teeth #9 and #10 (Fig. 4).

The photograph, however, was degraded by the absence of a ruler and a tangential orientation of the film-to-subject plane. It was felt that, even though these oversights precluded size or perspective control, there was sufficient characteristic detail to proceed with analysis. The mandibular arch was not interpretable, showing too much distortion to indicate more than the presence of all lower anterior teeth. The photograph was rephotographed in black and white

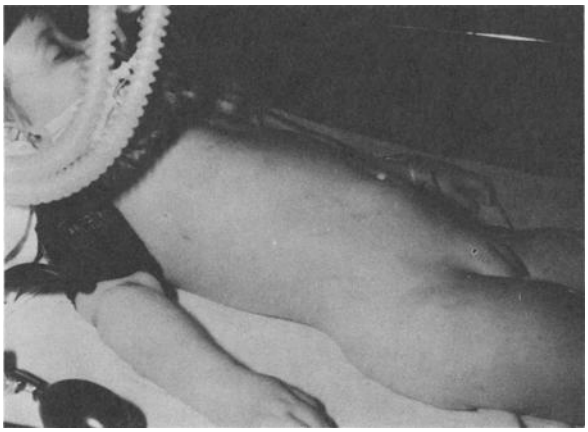

FIG. 4—*Patient in coma shortly before death, depicting bite mark in abdomen lateral to the umbilicus. Maxillary arch is most lateral.*

using a green filter to enhance contrast of the ecchymotic tooth marks (Fig. 5). Study models of a suspect were photographed parallel to the occlusal plane with a ruler properly positioned to allow the enlargement of accurate life-sized prints (Fig. 6). Transparent tracings of the biting edges were superimposed on the bite mark photograph which had been arbitrarily enlarged to conform to the intercuspid distance of the suspect. This is justifiable as long as the arch size is not used as a discriminator; the intention was to see how the other four incisor teeth fell into place. It can be seen that the dental positions align exactly into the individual contusions in the mark, with respect to labiolingual, mesiodistal, and rotational conformations, giving a total of four highly concordant points (excluding cuspids) (Fig. 7).

Additionally, when the maxillary study casts were pressed into wax to produce their incisal signature, other points of comparison were demonstrated (Fig. 8). The long, sharp Tooth #6 made a smaller, deeper hole in wax than its shorter, blunter antemere #11. This is reflected in the bite mark as a smaller, darker bruise in the #6 area compared to the wider, lighter #11 bruise (compare Figs. 5 and 8). Likewise, the long #9 made a deep indentation and produced a comma-shaped distal palatal curve in wax, constituting two unique features also reproduced in

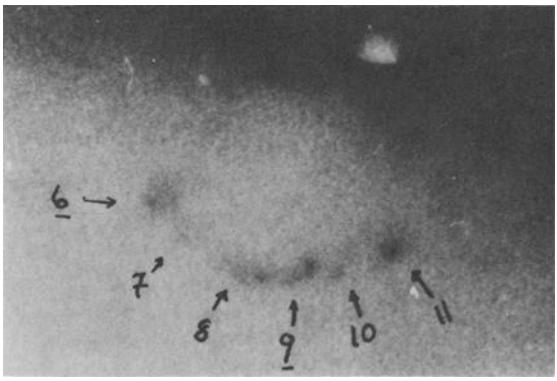

FIG. 5—*Enhanced photograph of bite mark enlarged to conform to intercuspid distance of suspect. Tooth numbers assigned according to morphology. Note V-shaped arch, palatal comma-like extention of distal of #9 and palatal rotation of #10.*

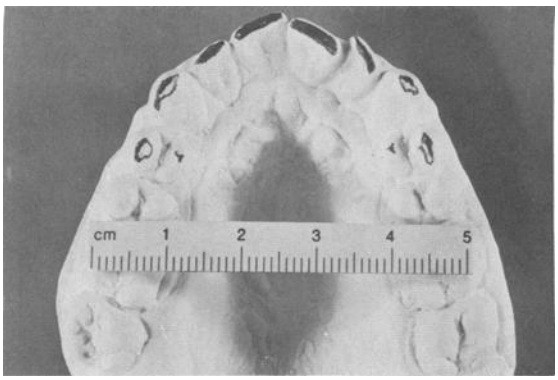

FIG. 6—*Life-sized photograph of maxillary study model of suspect.*

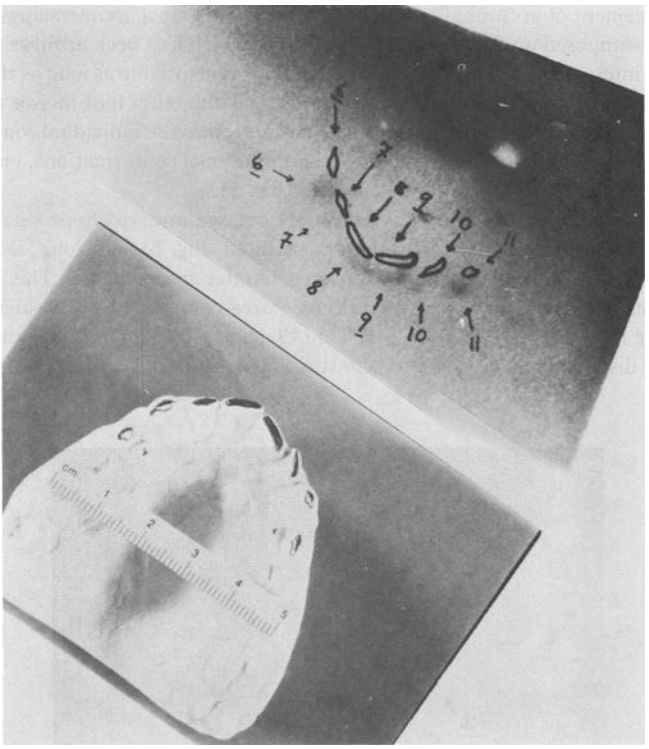

FIG. 7—*Acetate tracing made over photograph of mold of suspect's teeth and flipped over to be superimposed on bite mark. Actual superimposition is not attempted to allow reader to view the pending match. Reader can duplicate the results by constructing similar acetate tracing on Fig. 6 and placing it over Fig. 5.*

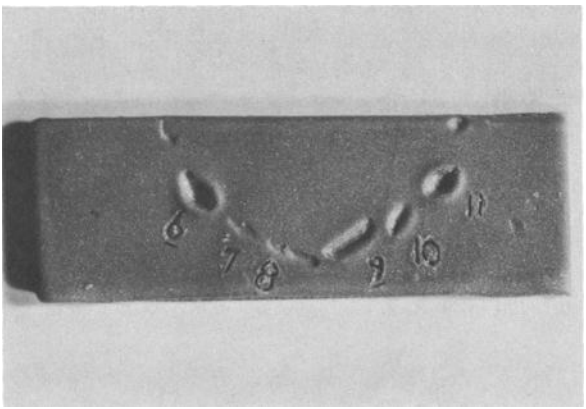

FIG. 8—*Wax bite made by pressing study model into softened wax. Note #6 is wider and shallower than its antemere #11 which is smaller but deeper. Compare to bite mark which shows #6 to be wider but lighter than #11. Similar concordance can be shown between #8 and 9 and 7 and 10.*

the bite mark (compare Figs. 5 and 8). The V-shape of the arch was also comparable. Concordance of specific features in this well inflicted and uniquely characterized bite mark concluded a high degree of probability to the point of reasonable dental certainty that the suspect was the perpetrator. Such was the testimony and a murder conviction resulted.

Discussion

Most references that deal with the technical handling of bite marks specify the recording of accurate measurements and the elimination of distortion so that the size of the bite mark can be compared to the size of a suspects' dental arch [*1,7,9-14*]. The ABFO, attempting to ensure scientific validity and establish uniformity in bite mark analysis had incorporated these considerations in their guidelines. Yet, the Bite Mark Committee of the ABFO, in a workshop at the 1984 Annual American Academy of Forensic Sciences (AAFS) meeting, collected cases that demonstrate significant disparity between the size of the arch of a known perpetrator and the bite mark he produces as a result of elasticity or repositioning of the skin. This was illustrated in our first case and other authors have cautioned that bite marks may be distorted by a variety of factors [*8-10,14-16*]. It appears as if an exact match in arch size is fortuitous and unpredictable, questioning the significance of this criterion.

Devore [*14*] agrees that when the exact position of a bite cannot be determined, photographic superimposition assessing size comparisons are meaningless. In *State of Vermont v. Howe*, [*17*] it was decided that precise measurements are not important if there is an obvious eyeball match. These conclusions suggest that, as in our second case, failure to employ a scale, although undesirable, may not be an insurmountable error. In such cases, the bite mark may be arbitrarily adjusted to the size of the suspects' arch in order to compare other aspects. It is not inappropriate or prejudicial to fix intercuspid distances since they are remarkably alike in humans. Morreess [*18*] recorded a mean maxillary intercuspid distance of 33.74 $\pm$ 2.52 mm among 45 males. An average maxillary arch width of 32.3 mm was determined from almost 400 wax bites of adults selected to represent a cross section of Americans in a study by Rawson [*19*].

This report is intended to expand and refine, rather than undermine established photographic protocol. Failure to control perspective and size is not being condoned and constitutes inexcusable technical mishandling. However, the goal of accurate reproduction of the bite mark must be considered in perspective. Its intention is not to provide exact superimposition but rather to preserve maximal visual information and reduce additional error in an already

unpredictably distorted finding. Hence, failure to achieve such technical precision degrades but does not necessarily invalidate the evidence. Our second case illustrates this concept. Poor photography precluded the use of the mandibular arch, thereby halving the value of the evidence. Yet clearly demonstrable unique features that were preserved in the picture retained their evidentiary value.

In summary, two bite mark cases are presented. The first case shows that the size of the mark need not conform to the size of the perpetrator's arch and suggests that bite marks be photographed in a range of positional possibilities when the position during biting is unknown. The second case, drawing on findings of the first case, suggests that failure to include a scale or to control perspective in photographs, though serious, need not necessarily disqualify the evidence so long as the uncontrolled variables are acknowledged and accounted for in the conclusion.

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