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Unusual Three-Dimensional Bite Mark Evidence in a Homicide Case

Under favorable circumstances, bite mark evidence may provide important information about the perpetrator of a crime, as reviewed in several textbooks [1-4] and articles [5-7]. In the case reported here, the remarkable depth and clarity of the bite marks, coupled with the distinctive nature of the suspect's teeth, played a significant role in the defendant's conviction in the strangulation death of a sexually molested woman. This is believed to be the first case in California in which bite mark evidence played a major role in the investigation and subsequent trial.

Case Report

On 4 Feb. 1974, neighbors of an elderly woman residing in Torrance, Calif., noticed that she had not followed her normal custom of appearing in front of her house with her morning cup of coffee. Two neighbors approached the house at approximately 3:00 p.m. and through the window they observed the woman lying seemingly lifeless on her bed. Upon arrival of competent authorities, it was determined that the woman had been dead for at least 10 h. Furthermore, no evidence was found to indicate that there had been any forcible entry into the house.

Autopsy

At autopsy, it was determined that death was due to asphyxiation resulting from manual strangulation. There was also a potentially fatal wound in the genital area, apparently made by a knife, extending through the vagina, large bowel, and abdominal cavity. Tests for semen and acid phosphatase were negative, possibly obscured by extensive hemorrhagic and fecal contamination.

During autopsy, the body of the victim, including the face, the dorsum, and the base of the nose, was photographed with an adjacent measuring scale (Fig. 1). The decedent was buried in a family neighborhood in Dallas, Tex., on 7 Feb. 1974.

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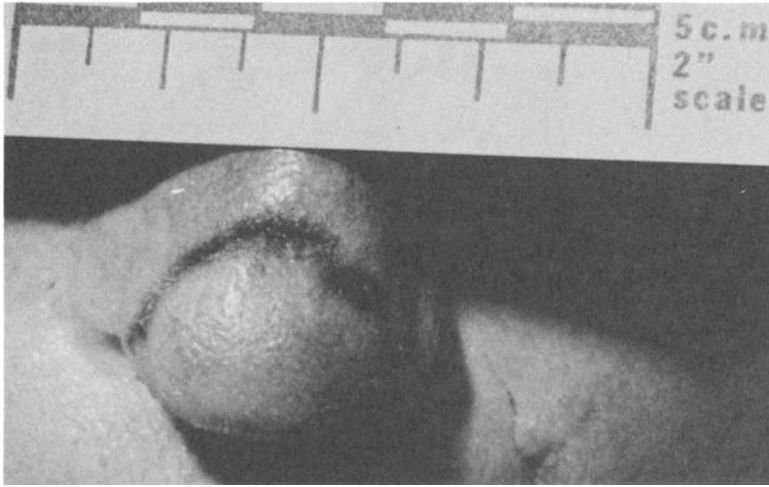


FIG. 1—Semicircular area of hemorrhage on the anterior portion of the nose, photographed at the time of autopsy of the strangled victim.

Development of Further Evidence

Suspicion focused on a 32-year-old man who had been a part-time boarder in the decedent's home, and thus presumably might have had access to the home without forcible entry. The suspect admitted having visited the decedent the evening of 3 Feb. 1974, the day before the body was found. His reason for leaving the victim's home and checking into a nearby motel, purportedly because of a contemplated early morning fishing trip, did not check out satisfactorily on further investigation. He was taken into custody on 11 February, after which a court order was obtained to secure samples of his blood, urine, saliva, and hair, as well as impressions of his teeth. The suspect initially refused to comply with the court order and therefore was kept in custody until he finally relented. Then, on 20 March, impressions of his teeth were made at a local dentist's office, using alginate impression material. Dental stone (a hard plaster of paris) was poured into these negative impressions, thus creating positive casts of the suspect's teeth. Thereafter, he was released from custody.

The Los Angeles authorities also arranged to have the victim's body exhumed. When this was done, on 23 March, the marks on the victim's nose were re-examined and replicated at the Southwestern Institute of Forensic Science in Dallas, in the presence of two Torrance, Calif. police officers (Figs. 2–5). The area around the deep epidermal bite marks on the nose was carefully cleaned with saline before replication and a preliminary comparison was made between the nasal skin marks and the plaster of paris models of the suspect's teeth. Using a polysulfide rubber-base impression material, three impressions of the marks on the nose were made and brought to Los Angeles by the Torrance detectives.

The impressions of the nose, dental models, and photographs were then referred to the Forensic Dentistry Branch of the Los Angeles Chief Medical Examiner-Coroner's office and a bite mark team of forensic dentists was formed to investigate the evidence.

Synopsis of Bite Mark Comparisons

Study of the photographs of the decedent's face and of the rubber-base impression of the decedent's nose showed a series of alterations in the surface of the nose. These

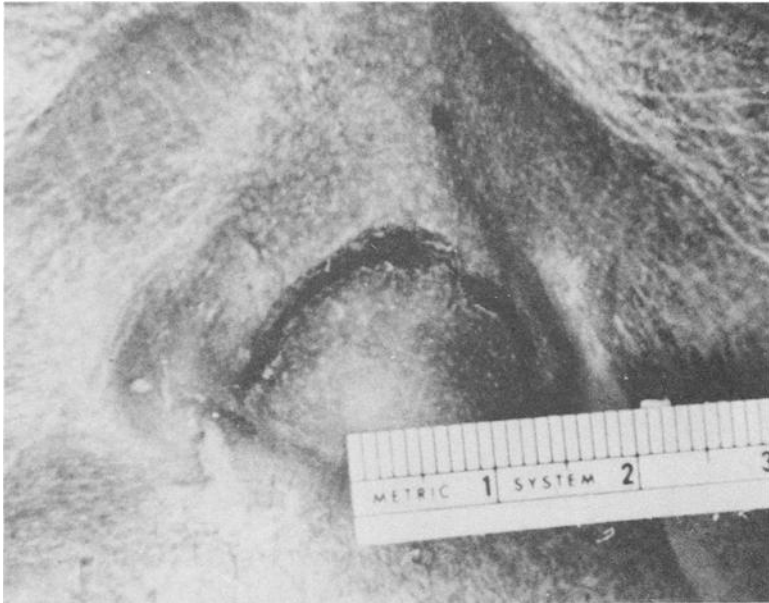


FIG. 2—The damage to the anterior portion of the nose of the victim, photographed again after the embalmed body was exhumed approximately six weeks after burial.

configurations were consistent with the kind of marks that could be inflicted by human teeth. This conclusion was based on the overall arrangement of the marks, the contour of individual tooth marks, and the ability to readily orient the marks with respect to size, shape, and position of the individual dental pattern. For example, the mark closest to the center of the nose was relatively wide, as well as being adjacent to a similarly

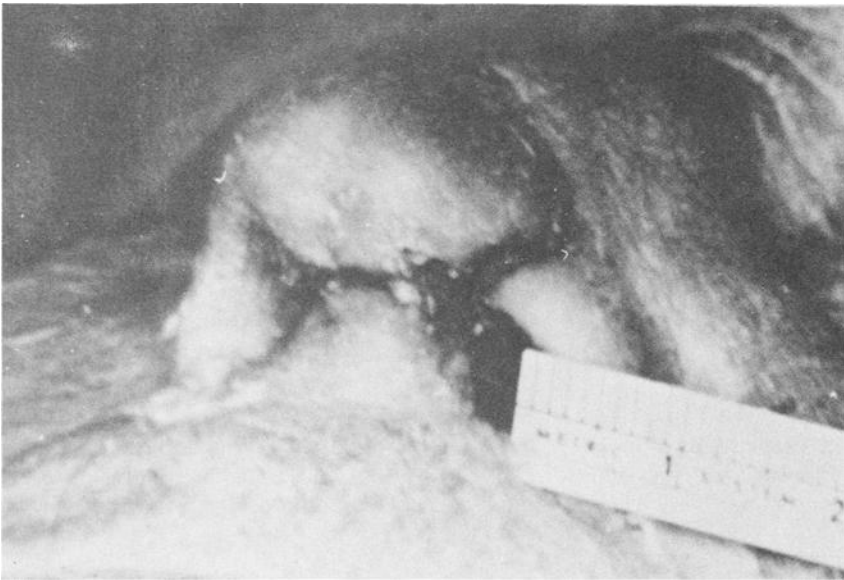


FIG. 3—The middle portion of the inferior surface of the nose of the exhumed body showing two minute indentations.

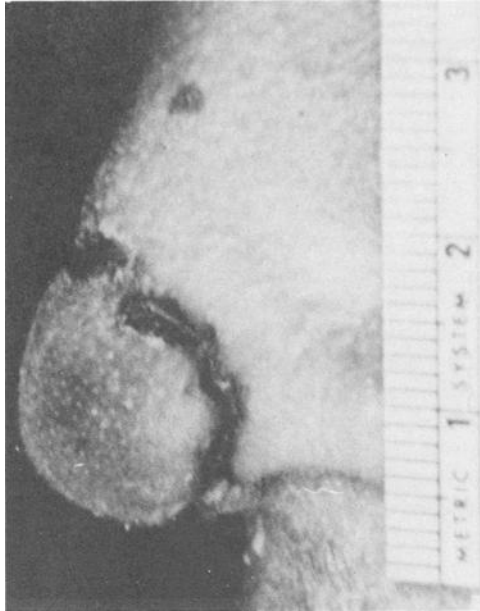


FIG. 4—Left lateral view of the nose revealed several lacerations after being cleaned with saline after exhumation of the body.

wide mark. Moreover, both marks were slightly convex on the outside, slightly concave on the inside, and were set between relatively narrower teeth marks of the

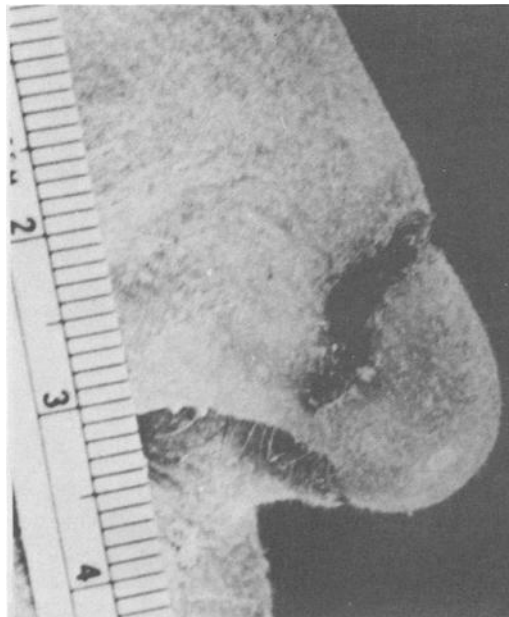


FIG. 5—Right lateral view of nose with exceptionally deep lacerations as they appeared when the nose was cleaned after exhumation.

dimension of smaller incisors. Thus, the size, shape, and relative position of the teeth made it possible to identify these first two marks as having been made by maxillary central incisors. The marks lateral to them in the photographs (especially to the viewer's right) were narrower in width and were consistent with marks made by maxillary lateral incisors. Further to the viewer's right was a mark in which a configuration corresponding to the cusp and convex labial surface of a maxillary canine tooth was evident. The ventral border of the nose showed two small marks consistent with marks of mandibular central incisor teeth. There were also sharp indentations suggestive of incisor-like marks on the lateral wings of the nose.

The defendant's dental models were duplicated, mounted, and studied on an adjustable dental articulator to permit examination of jaw movements and comparison between the suspect's teeth and the marks on the victim's nose.

The dental models revealed a dentition in a poor state of repair. Several teeth were decayed down to the gingival margin (gumline), most significantly the maxillary left canine. Both mandibular third molars and the mandibular left first molar were absent. The occlusion demonstrated a Class III tendency, that is, with the maxillary and mandibular central incisors in an edge to edge biting relationship. Maxillary lateral incisors were rotated and set markedly to the lingual, particularly their mesial aspects. These teeth also occluded in a crossbite relationship to the mandibular teeth.

A number of replicas were made of the decedent's nose. Initially this was done by pouring dental stone (Vel-Mix[®]) into the negative impression of the nose. Later, special models were made by using various plastic materials, such as silicones and epoxies, described elsewhere [8,9] (Figs. 6 and 7).

When an attempt was made to fit the suspect's teeth into the bite marks on the replica of the victim's nose, a high degree of correlation was found. The maxillary central incisors and the misaligned maxillary right lateral incisor were found to fit into the corresponding bite marks on the model of the nose. The impression of the nose showed evidence of a small diastema, similar to that between the suspect's maxillary incisor teeth. In addition, similarity in the relationship between the suspect's mandibular right central incisor, lateral incisor, and canine and the corresponding marks in the nose was observed.

To further study the dynamics of the bite, flexible rubber noses were produced using

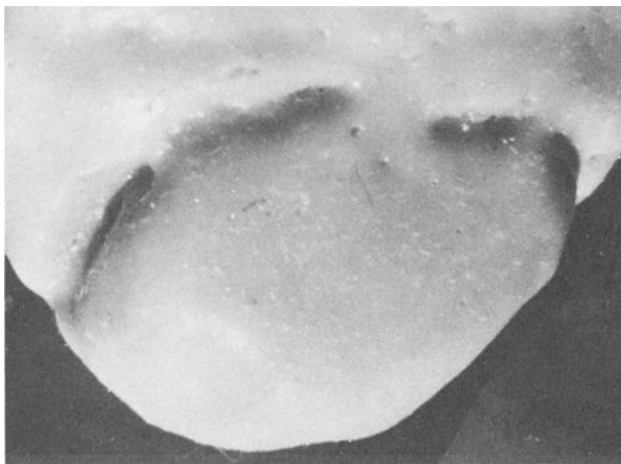


FIG. 6—Plastic model of the nose prepared from polysulfide rubber impressions of the victim's nose at time of exhumation reveals, in anterior view, three broad imprints, the width of human maxillary incisors, extending deeply into the surface.



FIG. 7—Plastic model of nose seen from the inferior surface shows two minute indentations of a size corresponding to the width of human mandibular incisors.

a material known as Dermathane 100®. Because the soft flexible nose models could be compressed under simulated biting pressure, it was possible to make more detailed test bites by duplicating the cast of the suspect's teeth in a solid, ivory-colored, epoxy resin (Figs. 8-11).

By referring to the scale used in the postmortem photographs, life-size prints (one-to-one) of the bite marks were reproduced in order to make direct comparisons between the epidermal bite pattern and the suspect's teeth. While several concordances were noted, the usefulness of this method was limited by the uniplanar nature of the photographs. When the models were laid on the photograph, only the bite marks lying in one plane were meaningfully compared.

Sample bites were made by pressing the dental models into various substances, such as modeling clay and dental base plate wax (Fig. 12). To permit better three-dimensional study, a series of wax noses was produced. This was accomplished by pouring melted wax into a mold made by taking an impression of a volunteer's nose in dental impression material. After the nose was made, the wax was again softened and sample bites were made into the nose using models of the suspect's teeth. In this



FIG. 8—Ivory-colored epoxy model of suspect's incisors in edge to edge occlusion.

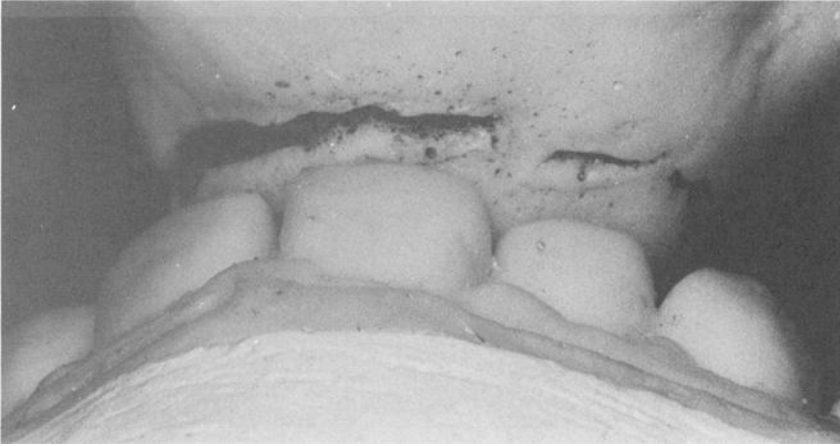


FIG. 9—Anterior view of the model of the victim's nose with suspect's dental cast approaching the deliberately darkened bite mark areas.

manner it was possible to produce a bite mark very similar to the bite mark on the decedent's nose.

Other comparisons were made by means of cellulose acetate tracing paper. Using a cast of the suspect's teeth, a tracing could be made of the cutting edges of the maxillary central incisor and maxillary right lateral incisor teeth. A similar tracing was made of the corresponding tooth marks in a replica of the victim's nose. When these two tracings were superimposed, they showed a marked concordance between the alignment of the suspect's teeth and the bite mark in the victim's nose. An additional tracing was made of the sample bite mark produced by the suspect's teeth in a wax nose. This



FIG. 10—Right lateral view of plastic nose model with suspect's dental cast placed in juxtaposition to the closely corresponding indentations on the nose.



FIG. 11—Soft rubber model of a nose prepared to indicate the probable relationship to the suspect's dentition at the moment when the bite marks were inflicted on the victim with the greatest biting force.

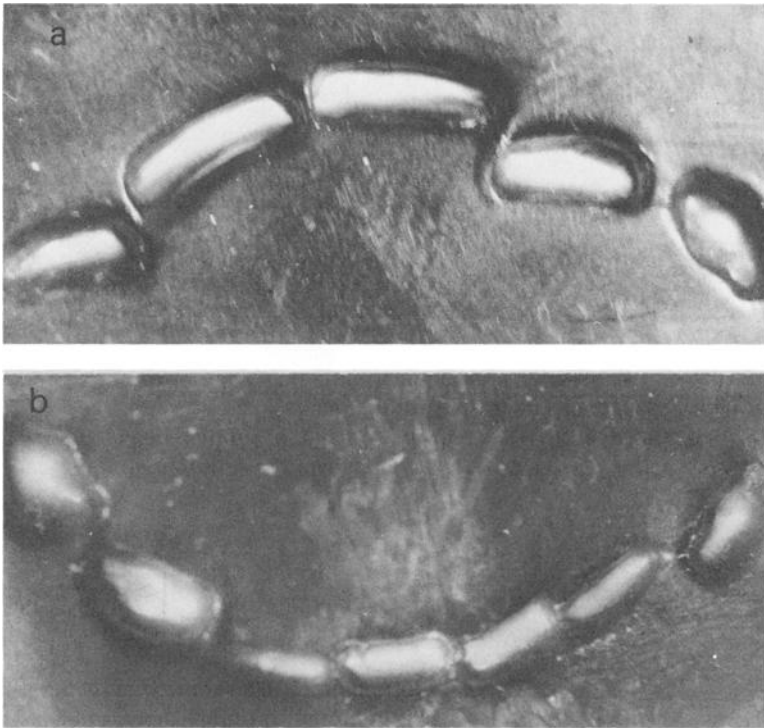


FIG. 12—Experimental bite marks produced by models of the suspect's upper (a) and lower (b) anterior teeth indicate characteristic bite patterns, especially with regard to the arrangement of the maxillary incisors.

tracing of the sample bite mark was similarly superimposed over the tracing of the actual bite mark in the victim's nose. Using this objective comparison method, it was found that there was a concordance between the sample bite made by the suspect's teeth and the actual bite mark in the victim's nose.

An additional comparison involved test bites made in the skin of a human volunteer. Articulated plastic models of the suspect's teeth were used to bite the skin of the forearm and of the nose of a police detective working on the case. The reddish color of the test bite mark in the nose, although the skin was not broken, strongly resembled the bite mark distribution in the victim's nose.

Scanning electron microscope studies were undertaken to permit more detailed comparison and to evaluate the condition of the epidermal cells and details within individual bite marks. The corresponding tooth surfaces and skin surfaces were microreplicated using a silicone compound⁵ Xantopren blue®, converted into positive epoxy resin models (Stycast 1266®), coated in vacuum with evaporated gold, and examined and photographed in the electron microscope using methods summarized elsewhere [10]. This study provided further information on the adequacy of the postmortem epithelial tissue preservation as well as on the three-dimensional outline of the maxillary and mandibular incisors vis-à-vis the corresponding marks on the dorsal and inferior surfaces of the nose. Further similarities, particularly with reference to profile contours and incisal edge characteristics, were also noted in this manner.

Still another method used for comparison purposes consisted of preparing silicone rubber matrices of the labial-incisal portions of the suspect's teeth. These matrices could then be laid directly on replicas of the victim's nose to compare features of the suspect's teeth and the bite mark; a high degree of concordance was again noted.

A court order was obtained and additional dental models and photographs were taken of the suspect's teeth. Direct clinical examination of the suspect's dentition and jaw movements supported the opinion that the suspect would have been likely to make a chop-type bite, favoring the teeth somewhat toward the right side of the jaw. This was the type of bite found in the decedent's nose.

Altogether, the dental investigators found 18 significant points of concordance between the victim's bite marks and the suspect's teeth, including such features as individual rotations, lingual displacements, diastema, and relative tooth dimensions. Seven of these points were adjudged to be distinctive or extraordinary, and thus of major significance.

Probability Considerations

Evidence of concordance was believed to be overwhelming. To illustrate the large number of alignments possible, one might consider only the five most distinctive tooth marks and assume that each tooth represented could be forward of normal alignment, in normal alignment, or set back from normal alignment. Also, each tooth could be rotated to the right or left, or show no rotation. In this example, each tooth would have nine possible positions and the total number of possible arrangements or combinations of the five teeth could be calculated to be 59 049. On a purely mathematical basis, therefore, the probability of a particular arrangement of these teeth occurring by chance would be 1 in 59 049. While this simple illustration omits other factors and is not presented here for evidentiary value, it does show that when a significant number of teeth have distinctive alignments and rotations that can be studied in detail, the possible number of combinations is very large and the chance of coincidental match is correspondingly small.

To further investigate the likelihood of a coincidental concordance, 710 randomly

⁵ Distributed by Unitek Corporation, Monrovia, Calif.

assorted models of adult dentitions were matched against the bite mark at two of the local universities. In 692 models it was immediately apparent that the individual in question could not have made the bite mark because of significant discrepancies in tooth alignment when compared with the bite mark, whereas 18 models had certain gross similarities to the bite mark. However, on simple comparative study using bite wax, each of these cases was readily excluded because of a variety of irreconcilable discrepancies. Not one of the 710 cases matched the bite mark. This study, however limited, supports the contention that the probability of some dentition other than the single suspect matching the bite mark would be less than 1 in 710. This agrees with the mathematical illustration which indicated that the probability of a chance match in this type of case is extremely small.

Comment

Human skin is a relatively poor impression material compared to substances routinely used for this purpose in dental offices. Moreover, the perpetrator of a human bite mark does not often leave his mark with a significant number of teeth accurately reproduced. For these reasons, it is relatively seldom that the investigator can state with a high degree of confidence that a given dentition does, in fact, match a bite mark. More commonly the conclusion would be either that a certain bite mark could *not* have been made by a certain dentition or that it *might* have been made by that dentition.

It has been stated that it is never possible to be certain that only a particular individual, and no one else in the world, could have made a particular bite mark; however, this is not the legal test for identification. A medical expert gives his opinion on the basis of reasonable medical certainty. He need not be absolutely certain, but only certain to a particular degree. Similarly, a jury need not be absolutely certain of guilt in order to convict, but certain beyond a reasonable doubt.

In the case at hand, the bite marks were remarkably clear and deep. Also, the defendant's dentition had a number of unique features, indicating a great many characteristic points of similarity to be matched against the observed bite pattern. At trial, the forensic dentists presented the supporting evidence to the effect that the defendant had made the bite mark on the victim's nose. A defense dentist challenged this conclusion. On 24 Sept. 1974, the defendant was convicted of manslaughter and was subsequently sentenced to 1 to 15 years. On 29 Dec. 1975, the Appellate Division of the Superior Court upheld both the conviction and the use of bite mark evidence.

Summary and Conclusion

A comparison has been made between bite marks observed on the nose of a female homicide victim and the configuration of the dental structures of a male suspect. The victim's bite marks showed a number of demonstrable characteristics which could be reproduced by models of the dentition of the suspect. Special peculiarities within and between individual teeth, together with the upper and lower jaw relationship, were demonstrably consistent with the bite mark patterns on the victim's nose.

Detailed examination of the scientific evidence led the dental investigators to the conclusion that there was a positive match between the suspect's dentition and the bite mark on the decedent's nose. The dental investigation and subsequent dental testimony were prime factors leading to the defendant's conviction of manslaughter in the first case in California involving the major use of bite mark evidence.

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