

CASE REPORT

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An Elliptical Incised Wound of the Breast Misinterpreted as a Bite Injury

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ABSTRACT: Bite injuries upon homicide victims are most often initially identified by the forensic pathologist during the course of the autopsy examination. Following such recognition, the injury or photographs of the traumatized site are then referred to a forensic odontologist for his or her examination, further characterization, and subsequent comparison with any suspect's dentition. However, if the pathologist misidentifies an injury caused by another mechanism as a human bite, this mistake can potentially be perpetuated by the dental consultant, since relatively few dentists regularly examine traumatic injuries other than those arising from bites. To illustrate such an event, a case is presented involving an incised wound of the breast, which was originally identified as an avulsive bite wound. Detailed examination by two odontologic consultants confirmed the wound as having been caused by human teeth, and further, they related the "bite injury" to a specific individual. The bite injury interpretation represented the only scientific evidence implicating the suspect at a subsequent trial for capital murder. Later examination of the tissues and photographs by a forensic pathologist and another dental consultant revealed that the injury was not due to human dentition, but rather resulted from a sharp-edged instrument. These consultants conducted a unique experiment to reduplicate the injury and prove its causation. This information was presented to the jury during the suspect's trial and resulted in his acquittal on all charges.

KEYWORDS: odontology, wounds, bite marks, avulsive wound, bite injury, dentist, forensic pathologist, homicide, human bite, incised wound, odontologist, postmortem examination, wound causation mechanisms

Interpretation of the patterned injuries which result from human bites has always been a challenging aspect of forensic medicine, requiring both an experienced pathologist to recognize the bite injury's true nature and an odontologist to characterize properly the dental arch orientation, individual tooth imprint arrangements and relationships, and other specific features. Properly identified and analyzed, bite injuries can be invaluable in identifying a perpetrator, especially in homicides or child abuse cases where the victim

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cannot otherwise identify the assailant. Equally important, accurate bite injury analysis may eliminate an innocent suspect from consideration, allowing police efforts to be directed towards other avenues in solving a murder or violent assault.

Proper bite injury analysis has two contingent factors. First, the pathologist performing an autopsy must correctly recognize (or exclude the injury as being the result of a human bite. The "typical" bite injury is often portrayed, for illustrative purposes, as a well-delineated oval aggregate of neatly arranged contusions with or without accompanying abrasions, with each distinct mark representing an impact point of the incisal/occlusal tooth surface or other coronal portions of the teeth with the skin and underlying tissues. In practicality, all of these features may not always be present or identifiable. Either the upper or lower arch may be missing, one or more individual teeth may not mark, or the injury can be compounded by multiple, overlapping bites. The teeth may have scraped over the skin, creating linear abrasions that can mimic another mechanism of infliction. Atypical bite injuries may be missed by the pathologist because they do not appear as the classic, characteristic example. Conversely, certain patterned injuries inflicted by instrumentalities other than teeth may be mistaken for bite injuries, causing confusion and misleading both forensic scientists and law enforcement officials.

The second contingent factor rests with the odontologist. Although experienced odontologic consultants are usually able to interpret a bite injury properly, problems may arise when an injury is mistakenly designated by the examining pathologist as originating from a bite. Most dentists are not routinely called upon to examine wounds caused by mechanisms other than teeth. If a pathologist misinterprets an injury as being from a bite, a real risk exists that this mistake will then be perpetuated by the dentist called in to examine the injury. Although this may seem unlikely, and in fact is probably an uncommon event, such misinterpretations can potentially result in the complete misdirection of police and criminalists, who then pursue actions to find the perpetrator of the mislabeled "bite." When this course is followed, the fallacious evidence generated may be improperly applied towards identifying a suspect in a specific crime. In an extreme situation, an innocent individual may be charged with a crime solely on the basis of an injury misinterpreted as a bite imprint pattern wherein "matching" of the suspect's dentition to the supposed bite injury has the potential to achieve conviction wrongfully. This unfortunate and undesirable outcome is to be avoided at all costs.

The following case illustrates a sequence of events wherein a suspect was identified, indicted, and brought to trial on charges of murder, based solely on a breast wound which was misidentified as a bite injury. This error was compounded and perpetuated by the opinions of two other odontologic consultants before the material was reviewed by a third odontologist and a forensic pathologist, the latter experienced in the examination and interpretation of other wound causation mechanisms.

Case Description

On an evening during the middle of summer, a 40-year-old Native American woman left her shift at a small hospital but never arrived home. The next morning her truck was found locked and parked in the hospital parking lot, and an intensive search ensued. Several hours later, her nude body was located partway down a steep gorge near the hospital.

The autopsy examination revealed that the cause of death was most probably suffocation, denoted by petechial hemorrhages involving the conjunctivae, sclerae, and lips. Two scalp lacerations on the left lateral parietal region denoted blunt impact injuries, which most probably had rendered her unconscious prior to being suffocated. No genital injuries were apparent, and subsequent vaginal swab analysis detected no evidence of either spermatozoa or acid phosphatase. There were no defensive injuries.

The most interesting and unusual injuries were located on the left breast, where both the nipple and areola and the immediately underlying central lactiferous ducts and adjacent fatty tissue were absent, in a relatively regular oval configuration (Fig. 1). Immediately adjacent to this, laterally, was a semilunate injury which extended through the skin and into the subcutaneous fat. Both injuries were described as "lacerations" by the pathologist, who performed the autopsy. A local dentist was consulted, and the substantial breast injury was interpreted as a possible avulsive bite. After photographs and impressions of the area were taken, the tissue surrounding the missing central breast region was excised, including the laterally placed accessory wound, and was fixed in formalin. A complete absence of hemorrhage within the breast tissues around either wound indicated that the injuries had been sustained after death. The missing breast tissue from the dead woman was never located.

The initial law enforcement investigation focused upon the dead woman's boyfriend, who had been known in the past to drink heavily and beat her. However, a few days later, another suspect was developed when a local man told his minister that he had dreamed about the murder. This man was a member of a religious group that believed, among other things, that dreams were a reflection of real events, and he felt that his dream gave him prophetic revelations that could possibly assist the police. They questioned him at length, often asking leading questions, and although later detailed analysis of his interview disclosed that he actually knew little more than what had been reported in the newspapers (much of which was factually erroneous), he was subsequently arrested and charged with the crime. Following his arrest, dental impressions were obtained and dental models constructed. The models, injured breast tissue, and the breast impression taken during the autopsy were referred to a forensic odontologist. This consultant returned a report that stated that not only was the injury definitely caused by a human bite, but that the individual characteristics of the injury identically matched the suspect's dentition. This opinion was later corroborated by another odontologist consultant. On this basis, the suspect was charged with murder. Despite the fact that no other definitive physical or circumstantial evidence ever developed, the man was eventually brought to trial on these charges.



FIG. 1—Autopsy photograph of the breast wounds. The nipple and areola are missing centrally, and an adjacent semilunate injury is located laterally. Note the absence of subcutaneous hemorrhage, indicating that the injuries are postmortem.

Subsequent Tissue Examination

The excised breast tissues were obtained by the defense counsel, who brought them to us. The two wounds were scrutinized separately. The semilunate, laterally positioned wound extended into the fatty tissues and was relatively sharply marginated. Although the margins exhibited drying and brown discoloration, there were no abrasions. Upon high-magnification examination, the inferior wound extremity was observed to contain a minimum of four distinct, linear, superficial tailing cuts of the skin (Fig. 2). All of these features indicated that the wound had been caused by repetitive, superimposed cutting motions with a sharp-edged instrument, most probably a knife.

Close scrutiny of the large oval wound revealed other significant findings. Although focal regions around the circumference were darkened, these were not abrasions but reflected postmortem drying of the exposed dermis and superficial subcutaneum. No abrasions were identified at any point around the wound. Several areas exhibited a striking scalloped appearance (Fig. 3) which suggested outlines of individual tooth margins. However, the edges were all sharply delineated rather than torn, abraded, or fragmented. In

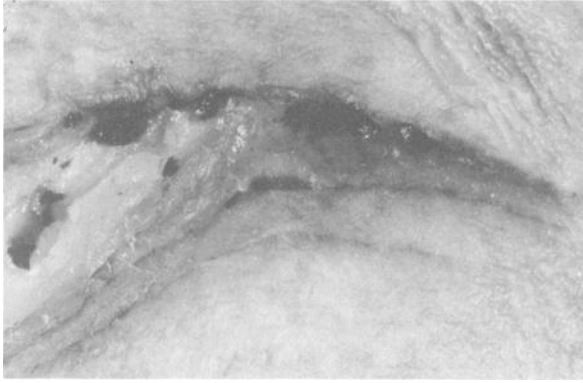


FIG. 2—Close-up view of the semicircular injury, at its inferior extremity. Several parallel superficial cuts are apparent, suggesting causation by a sharp-edged instrument.

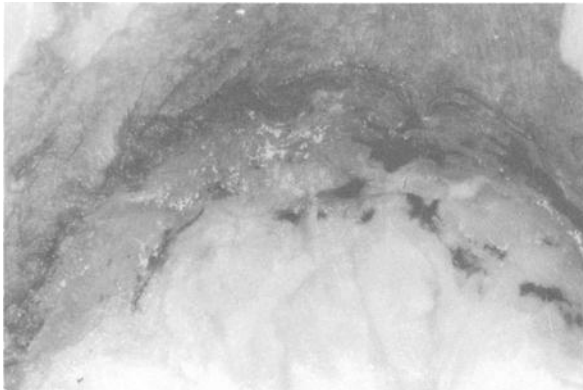


FIG. 3—Focal scalloping of the excised and formalin-fixed breast wound, mimicking tooth imprint patterns.

some regions, high magnification disclosed small, dog-eared flaps of tissue separated from the margin by sharply marginated, clean cuts into the adjacent skin (Fig. 4).

The central tissues, including the lactiferous ducts, the overlying nipple and areola, and the periductular fat had been cleanly removed, without evidence of tearing, tissue bridging, or the protruding ends of small vessels. The deep fat appeared to billow into the wound (Fig. 5) in a regular, smooth distribution. The missing tissue defect assumed the form of a conoid plug, extending deep into the ductular network centrally.

After these injury patterns had been documented, the question of mechanism was addressed. All of the features identified indicated that the tissues had been excised with a sharp instrument, such as a knife, rather than avulsed by human teeth. The scalloped margins with focal, small flap-like tissue extensions, coupled with the deep central defect and the smooth surfaces of the exposed fat, indicated that the most probable way in which the tissues had been removed was by knife blade insertion into the breast at an angle pointing towards the deep central area, with gradual removal and reinsertion of the blade while cutting circumferentially. Essentially, the reconstructed knife action uti-



FIG. 4—A small tissue flap along the wound periphery. Two small, parallel cuts in the superficial skin extend away from the tip of the flap.

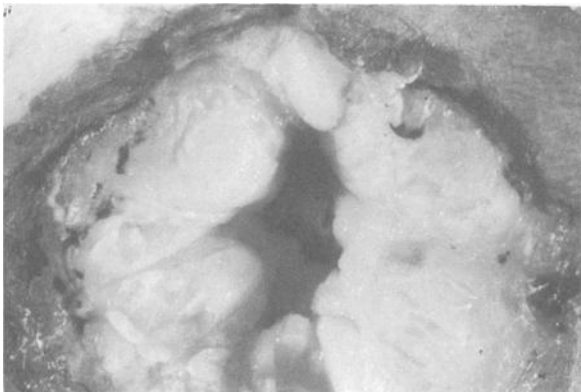


FIG. 5—The deep fatty tissues billow into the central cone-shaped cavity of the breast wound. There is no evidence of tissue bridging or tearing. The deep central ductular structures have been cleanly removed.

lized a motion akin to the coring of an apple. Such a cutting procedure would create a scalloped margin because of the repetitive blade movements and also would cut the deep breast fat and ducts cleanly without creating tearing or tissue bridging.

Experimental Observations and Subsequent Trial Presentation

As the specific question of wound causation was central to successfully convicting the defendant of a brutal murder, a simple experiment was undertaken to attempt a reduplication of the avulsive breast wound and thus show beyond reasonable doubt that the wound did not originate from a human bite.

The body of a young adult woman who had been killed in a traffic accident was utilized. One breast was draped, and a medium-sized pocket knife was used to cut through the periareolar tissues in a manner identical to that postulated as the actual mechanism through which the tissues had been removed from the murder victim. The knife was inserted at an approximately 45° angle angulating towards the central subareolar ducts, and was repeatedly partially withdrawn and reinserted while cutting laterally around the areolar circumference (Fig. 6). When this process had been extended around the entire nipple and areola, an oval, crateriform defect was created, which was strikingly similar in appearance to the actual victim's wound (Fig. 7). Peripherally, small angulated skin and tissue flaps were evident around much of the circumference, along with scalloped areas (Figs. 8a and 8b). These were quite similar to the small flaps from the victim's breast defect. The periductular fat tissue was smooth, without fragmentation, tearing, or bridging fibers, and ballooned slightly into the central defect.

After the wound was created, the dental models from the defendant as well as 15 other nonrelated models were positioned at various places around the periphery, and, with judicious placement, the teeth from all the models could be made to match exactly the marginal contours, thus mimicking a "bite injury" (Fig. 9). Following completion of the experimental studies, all of the excised tissues were carefully sewn back on to the breast, completely restoring the cosmetic appearance.

All of these steps were photographed in sequential detail, and this evidence, along with photographs which depicted the sharply marginated cut defects in the decedent's breast tissue, were presented and described during the defense phases of a jury trial. The brunt of the prosecution's case had focused upon the injury as a bite wound, and their experts strove to prove that the injury had been caused by the defendant's teeth, to the exclusion



FIG. 6—The early stages of reduplicating the breast injury. The nipple and areola were grasped and retracted by the left hand and the knife blade was inserted at an angle into the breast tissues towards the deeper central regions. Some marginal irregularity is already apparent.



FIG. 7—*The experimental wound after complete excision of the central tissues. Note the similarity to the actual breast injury in the murder victim and the absence of deep tissue bridging and marginal abrasion.*

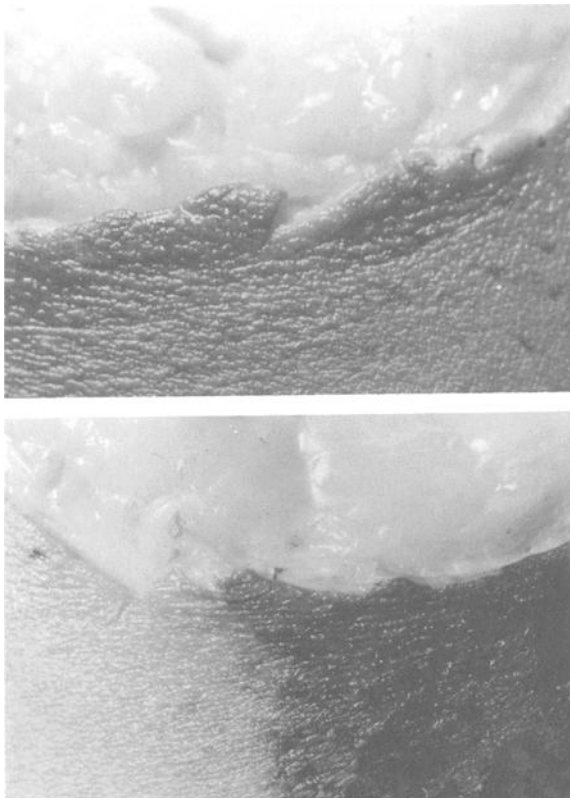


FIG. 8—*Close-up views of two portions of the experimentally produced excised wound circumference. Both scalloping and small tissue flaps are apparent, with appearances similar to those in the actual breast injury.*

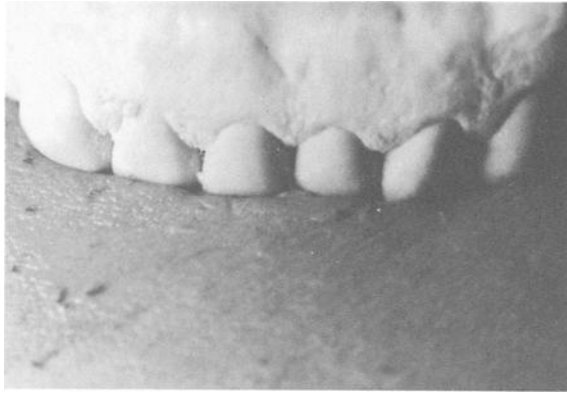


FIG. 9—The suspect's dental molds were positioned along the periphery of the experimentally produced wound, to simulate a bite injury, and reveal the ease with which this might be accomplished. Here, the mandibular cast matches the "bite injury" quite well. This procedure duplicated the technique used by the prosecution to prove that the defendant's dentition matched the breast injury margins.

of all other persons. All of the prosecution measurements centered upon a correlation of the defendant's dental arches with the contours of the victim's breast wound, and such a comparison was made by superimposition of the arch and teeth patterns onto enlarged photographs of the formalin-fixed tissue.

The jury deliberated for four hours and returned a verdict of acquittal. After this verdict was read, the family of the dead woman, who had been sitting in the courtroom gallery during the trial, approached the acquitted man, surrounded him, and hugged him. They had steadfastly maintained throughout the entire investigation and prosecution that the law enforcement agency and district attorney's office had charged the wrong individual with the crime.

Discussion

Since the first utilization of bite pattern injury evidence in courts in the United States in 1954 [1], forensic scientists and the law have gradually come to recognize their usefulness in criminal investigation [2]. The development of techniques to detect, document, and preserve bite injuries for subsequent detailed analysis in both living and dead individuals as well as in food products has aided the resolution of innumerable violent crimes. Bite injury interpretations may at times be far from perfect, however, and many factors can influence their usefulness. At least one conviction has been overturned on the basis of inadequately interpreted bite injury evidence, which incorrectly incriminated the wrong suspect [3], and this emphasizes the somewhat subjective parameters which are frequently utilized to scrutinize bite patterns.

Despite the best and most advanced scientific approaches, bite pattern evaluation is subject to numerous variables. Perhaps the most significant relates to the part of the body upon which a bite is located. The position of the body part when bitten, differing degrees of epithelial thickness, variations in the subcutaneous fat thickness and density, the course of Langer's lines, and the skin elastic tissue content may all combine to modify the overall appearance and configuration of bite injuries. When these injuries are recorded photographically, tissue distortion may be present in the rounded, softer, and more variable parts of the body. A thorough understanding of these factors is crucial to bite mark interpretation, and improper scale positioning or excessive tissue distortion will

significantly diminish the possibility of deriving useful information [4]. Although all of the above must be taken into account, pattern recognition and analysis is, most frequently, only minimally affected by the relatively small area of the bite injury itself.

In the case reported here, the purported "bite" was located on the breast, a common site for true bite injuries. In one large series, breast bites were the most commonly encountered injury site (19.2%) in female victims [5]. The female breast is extremely variable from person to person as far as size, consistency, shape, and elasticity are concerned, and effective bite injury interpretation may be hampered by the simple distortions brought about by compression between human jaws [6].

Most bite injuries, even of the softer portions of the anatomy, consist of varied mixtures of abrasions and contusions. More infrequently, severe force will achieve deeper abrasion and laceration through the cutaneum. Human teeth do not function in a scissors-like fashion, as those of carnivores do, but they are particularly structured to tear and crush. In addition, human skin is surprisingly resilient. A human bite will not cut through skin readily but results most often in epidermal abrasions, contusions, tissue bridges, and irregularity, all of which are typically associated with lacerations rather than incised injuries. So-called "avulsive" bite injuries are rare and are nearly always rather superficial; human dentition will not readily excise large portions of tissue. On the breast, avulsive injuries usually involve only the nipple, which may be partly or completely bitten away. Large, deeply cavitated defects which are relatively smooth and have clean, unabraded margins are essentially impossible to achieve with human teeth.

Another facet of bite injury interpretation which may inadvertently cause difficulties relates to tissue removal and preservation by the pathologist. The relationships between the individual tooth impression injuries are most critical when the tissue is *in situ*, upon the body. These relationships are irretrievably altered when the tissue segment bearing the bite injury is removed, and even more so after the tissue is placed in preservative solution. Skin and subcutaneous tissue is quite malleable when freed from the adjoining stresses of elastic cleavage lines and may be freely shaped in virtually any contour, thus altering any patterned configurations present upon the surface. Formalin preservation causes tissue shrinkage, which commonly is as much as 10 to 20%, thereby eliminating the reliability of any further measurements taken from the fixed tissue [7,8]. In this case, the tissue shrinkage varied from a low of 15% to a high of 86%. Although removal and tissue fixation impairs further comparisons, it is nonetheless occasionally useful for retaining and preserving a bite injury. Wetli et al. [9] describe a careful method which attempts to preserve the soft tissue relationships and the bite injury contours, although measurements are still rendered inaccurate after preservative fluid fixation.

In the case delineated here, many of the crucial interpretations presented to the jury as evidence that the "bite" was caused by the accused individual were based upon measurements and dental arch overlays taken from the excised breast tissue, which had been fixed in formalin for between two and three years. This methodology is in direct contradiction to accepted bite injury interpretation practice, since the introduced margin of error is huge. To assist the jury further in understanding the potential danger inherent in making reliable judgments based upon excised tissues, the experimentally created "bite injury," done with a medium-bladed knife, was further excised from the surrounding breast tissues. This tissue was arranged in several positions and photographed to reveal how differing "dental arch" patterns were possible to create with minimum effort, thus further diminishing the significance of detailed measurements made from the excised and preserved victim's breast.

Conclusion

There is no doubt that pathologic and odontologic bite injury identification and interpretation is a vital tool to help solve violent crimes. These techniques can also readily

be applied to protecting the innocent through exclusion on the basis of dental arch patterns and tooth arrangements. However, it is imperative that scrupulous procedures be followed during the identification, recording, and interpretative phases. Any factor which will have the effect of altering the bite injury pattern must be avoided, since further detailed measurements are then rendered useless.

When an injury is initially evaluated, and consideration is given toward the possibility of a human bite origin, the first question to be asked is, "Is this truly a bite injury?" This question must be answered by experienced individuals, whether pathologists or odontologists. If the answer is affirmative, the next two questions are "What portion or portions of the dental arcade does it represent and what class and individual tooth characteristics does it contain?" These two questions must be always addressed in sequence, as the application of the second query is wholly dependent upon the answer to the first. If this process is altered, and the basic presence or absence of an actual bite pattern injury is not adequately addressed, the eventual outcome may be disastrous.

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