BITE MARKS FROM THE CRIME SCENE- AN OVERVIEW

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Abstract

In mortal combat situations, such as the violence associated with life and death struggles between assailants and victims, the teeth are often used as a weapon. Indeed, using the teeth to inflict serious injury on an attacker may be the only available defensive method for a victim. Alternatively, it is well known that assailants in sexual attacks, including sexual homicide, rape and child sexual abuse, often bite their victims as an expression of dominance, rage and animalistic behaviour. The teeth are a significant component of our natural arsenal. It is suspected that many dentists have seldom considered their patient's teeth as such effective weapons.

This article aims to address the forensic, physical, biological and psychological aspects of this important tool of evidence from the crime scene:-Bite marks

Key words: bite marks, evidence, forensic dentistry

Introduction

Forensic dentistry is the application of dental knowledge to those criminal and civil laws that are enforced by police agencies in a criminal justice system.[1] Forensic dentists are involved in assisting investigative agencies to identify recovered human remains in addition to the identification of whole or fragmented bodies; forensic dentists may also be asked to assist in determining age, race, occupation, previous dental history and socioeconomic status of unidentified human beings. Identification is done by the comparison of antemortem and postmortem dental records and using the unique features visible on dental radiographs, including both those resulting

from dental treatment and those occurring naturally.[2] Human bite marks is one among the most violent crimes tried in the criminal courts. Bites have been found in cases of homicide, attempted suicide, sexual assault, assault and child abuse.[3] Bites can occur on both the victim and the suspect: teeth are used as weapon by the aggressor and in self defense by the victim.[4] Although they are only a small portion of most forensic dentists case load, bite marks represent the most challenging aspect of the discipline.

History

The contemporary history of bite marks is thought to have started with Sorup. In 1924, Sorup used transparent paper upon which biting edges of a suspect's dentition were rendered to compare with life size photographs of a bite mark.[5]The earliest bite mark case documented by the U.S law is thought to be reported in 1870. Charged of murdering his mistress, Ansil Robinson was acquitted despite the fact that evidence matching his teeth to a bite mark on the victim's arm was presented.[6]

Human Bite marks as Forensic Evidence

Human bite marks are most often found on the skin of victims, but they may be found on almost all parts of the human body. Females are most often bitten on the breasts and legs during sexual attacks, whereas bites on males are commonly seen on the arms and shoulders. In defensive circumstances, as when the arms are held up to ward off an attacker the arms and hands are often bitten.

The appearance of a bite mark is dependent upon a number of different variables, such as anatomical location (fat deposition, underlying hard tissue, skin thickness, elasticity, and vascularity), number of

teeth contacting the skin, amount of force, direction and type of biting action, the biter's occlusion and oral health, and whether the victim was alive when the bite was inflicted.[7] In living victims, the effect of healing will alter the appearance of a bitemark over time. Postmortem bites lack the classical erythema and contusions found with antemortem bites. Bites can also be found on foodstuffs and less frequently on a variety of other materials such as chewing gum and paper towels. [8,9,10]

Bites usually appear as oval or circular contusions, bruises or abrasions. Sometimes indentations, lacerations or avulsions made by specific teeth are seen on the skin surface. In most cases, bites have been identified with molar teeth represented on the injury. A double-arched pattern is a common presentation of human bites.[11] Despite the described presentations in terms of location, appearance and severity there are some basic features of bites that can be used to identify them. The initial identification of an injury as a bitemark is a prerequisite to the proper handling of the evidence.[11]

Bites can be created in a number of ways. They can be the result of direct contact from the teeth, by the tissue being pressed against the teeth by the tongue, or by a scraping action. Bites can occur singly, but are often present at multiple sites or multiple bites at a single location. Bite marks are therefore complex injuries and their recognition and interpretation of forensic significance relies upon a thorough understanding of the mechanisms involved.[3] Bite injuries can establish that a suspect was in violent contact with the victim. Bites can also provide evidence that a suspect was present at a particular crime. A bite on an abused child can indicate that other injuries may not be accidental. In order to ensure that this type of evidence is retained, it is important for odontologists to inform investigators about the proper recognition and preservation of bitemark evidence.

It is the role of forensic odontologists to confirm that a particular injury is indeed a bitemark, to collect the required evidence from both the victim and the suspect, and to analyze the bite in light of the collected evidence. Good practice encourages odontologists to present their results in a written report, adhering to strict guidelines relating to wording and levels of conclusion.

The central tenant of bitemark analysis is that each person has a unique dental arrangement and that these unique features are sufficiently replicated in a bitemark to identify an individual to the exclusion of all others.[12]The debate over the uniqueness of human teeth is probably one of the most fierce in current forensic dental discourse. An examination of the literature divulges the scientific evidence for this commonly held belief. Before this examination, it is pertinent to separate the dental uniqueness used in dental identifications from the uniqueness of human bite marks. Dental identifications use dental records and radiographs in a systematic and well-validated method that has little to do with the features examined during a bite mark analysis. There is little question that the identification of an individual based on their dental records is a sound, scientific, and reliable method of identification.[13,14]

The discussion about uniqueness of dentition is incomplete without the reference of the study conducted by Rawson et al. Rawson et al [15] in 1984 determined that the minimum number of positions that a tooth can occupy is 150 and the greatest 239.9. Using this premise, the article then stated that the probability of finding two sets of dentition with all six teeth in the same position was $1.4x10^{13}$. With an assumed world population of 4 billion ($4x10^{9}$), Rawson stated that a match of five teeth on a bite mark would be sufficient evidence to positively identify an individual as biter to the exclusion of all others. The article claims that dentition is unique, however when the article is cited other authors often extend this conclusion to incorporate it to the uniqueness of bite marks.

But as such the question about bite mark uniqueness remains unanswered till date. Many forensic dentists, and lawyers have questioned this fact and demanded to know from testifying experts the relative frequency of dental features identified in bite marks. By examining the ability of forensic dentists to

identify correctly biters from the bite marks, the issue of bite mark uniqueness can be answered. If it is quite clear that odontologists have a great deal of difficulty in correctly identifying bite marks, the question of uniqueness will become irrelevant.

Not all marks on skin are caused by human bites.[16] Many injuries can replicate the classical semi-circular appearance of a bite. Cardiac defibrillators and electrocardiogram monitors removed after a patient has died in an emergency room can leave bruises resembling the characteristics of a human bite.[17]

Accuracy of bite marks on human skin has been the most debated area in discussions of forensic significance. Skin is a poor registration material because it is highly variable in terms of anatomical location, underlying musculature, or fat, curvature, and looseness or adherence to underlying tissues. Skin is highly visco-elastic, which allows stretching to occur during either the biting process or when evidence is collected. In 1971, De Vore issued a preliminary report describing studies performed on the variability of bite marks found on skin.[18] The experiment involved the inking of human skin (living volunteers) using a stamp with two concentrically placed circles with intersecting lines. Following the analysis of the photographs it was found that in all the cases there was an expansion or shrinkage of the stamp, with a maximum linear expansion of 60% at one location.[18]

In 1974, researchers from the Bioengineering Unit of the University of Strathclyde examined the features of the biting process likely to impact upon the appearance of bite marks on human skin.[19] They described the differing characteristics of skin from a variety of anatomical locations; eg. Langer's Lines which represents directional differences in the degree of extensibility of skin. Like DeVore, they emphasized the importance of body location during biting since the directional variations or tension lines will alter with movement.[19] The report also described distortions that can occur on the skin after biting. The oedematous response of skin to trauma is likely to stiffen the area, thus rendering it more stable. However, the subsequent resorption of this fluid will cause a large amount of distortion. They concluded that the changes in bite mark appearance are likely to be greater as the injury grows older.

Human Bitemarks as Physical Evidence

Physical evidence is scattered around most of the crime scenes. This type of evidence can yield significant information about the nature and circumstances of a crime. Bite marks and tool marks are described as impression evidence in Saferstein's classification.[1] Many of the terms used in the discipline of toolmark or firearms examination can be applied to bite marks.

The examination of physical evidence by a forensic scientist is usually undertaken to identify its origin, and this is also true of bite marks. The analysis regimen for bite marks is broadly split into two main components. First is the metric analysis that involves the measurement of specific traits and features. Secondly, the comparison of the configuration and pattern of the bite injury to that of the suspect's teeth. This comparison is often referred to as pattern association.[20] Specific terms are used to describe the features or characteristics of patterned injuries.[21] Three main classification of characteristics exist: gross, class and individual.[21] Gross characteristics are those that identify the general origin of the object. A semicircular injury with central area of ecchymosis and small areas of incision or bruising demonstrates the gross characteristics of bite marks. Class characteristics can be defined as the properties of evidence that can only be associated with a group and never with a single source.[1] Sweet describes dental class characteristics as the number and shape of individual teeth and the familial arched arrangement of teeth in upper and lower jaws. Using measurements, a bite mark can be described as having been created by a child or an adult. Individualizing characteristics on teeth can be divided into two main categories: developmental and acquired. Developmental features that can be considered unique include prominent marginal ridges, additional cusps, talon cusps, macro-or-microdontia and genetic abnormalities of tooth form. Acquired characteristics include

restorations, fractures, occlusal adjustments, and occlusal wear.[7,22,23] These characteristics provide the odontologist with the necessary detail to enable a single person to be identified as the biter. It should be remembered that some dentitions are likely to be highly unique, exhibiting numerous individual characteristics while others, possibly in younger suspects, may offer fewer individualizing features.

Of importance in the final analysis is the replication of these individual features in the bitemark to an extent that they can be compared to the suspect's teeth.

Human Bite marks as Biological Evidence

In an attempt to address some of the limitations of bite mark analysis regarding the uniqueness and reproducibility, researchers turned to biological evidence. The potential for human bite marks to yield biological evidence has been known for many years.[24] Initially this evidence was limited to the blood typing of saliva stains using ABO antigen groups.[25] Later, Sweet found that saliva deposited by a biter could be collected, using a double swab technique, and would yield DNA for forensic analysis.[26] Now, it is possible to retrieve and analyze DNA from bites on victims who have been subjected to extreme environmental conditions.[27]The advent of the polymerase-chain reaction (PCR) technique has ensured that the DNA analysis will play an increasingly crucial role in the investigation of bite injuries. DNA analysis avoids many of the pitfalls associated with physical bitemark comparisons, but it does not represent a forensic panacea. Contamination, degradation, expense, and environmental assaults may restrict the use of DNA analysis. However, DNA analysis represents the most scientific, and defensible method of bite mark analysis currently available to the forensic investigator.

The advent of salivary DNA analysis raises an important question-why investigate physical analysis when more discriminatory techniques are available? Despite the clear advantage of salivary evidence, efforts are required to promote further this method within the field. Physical bitemark evidence will always play an important part in criminal investigations. The relative simplicity of physical comparisons is easily explained to juries compared to the seemingly esoteric nature of DNA. DNA can sanitise an attack, while the use of physical bitemark evidence can effectively demonstrate to a jury the violent and heinous nature of a crime. Physical evidence is, and is likely to remain a crucial part of bite mark evidence.

Human Bite marks as Psychological evidence

Recent advances in criminal profiling have suggested that a third source of evidence may be elucidated from bite marks, that of the psychological profile of the biter.[28] Research in this area is limited to three articles, with further work required to determine the value and validity of this source of evidence.[29,30,31] Walter RA elaborated the psychological aspects of bite marks and in doing so, elucidated three motivational dimensions: anger-impulsive biting, sadistic biting, and ego-cannibalistic biting.[29]The anger-impulsive bite is said to often result from frustration and incompetence in dealing effectively with conflict situations on the part of the perpetrator and is "governed by time, location, situation, and type of anger." The sadistic bite is said to satisfy the need for power, domination, control, and omniscience. The ego-cannibalistic biter bites in an attempt to satisfy ego demands by annihilating, consuming, and absorbing life essences from the victim.[29]

Current theories suggest that psychological techniques, such as personal construct theory, may also be applied to this aspect of bitemarks.[31,32] In essence the theory maintains, "If we want to understand other people, their thoughts, their feelings or their behaviour we have to know how these people allocate meaning to the things that happen".[32] The emphasis is very much on individual perceptions of the world, such as how we as individuals impose our personal constructions on events in an attempt to make sense out of them. It follows, therefore, that if we are able to elicit, examine, and explore what influences the personal construct systems of offenders who have bitten, they should tell us something new and highly relevant regarding the dimensions of

the behaviour we wish to understand.[33] It should be noted that personal construct psychology and the methodological techniques contained therein have been employed with offenders whose behavioural profile is most likely to include biting behaviour, namely, violent offenders and sex offenders. It is worrying to note that despite the dearth of validated studies in this area, psychological evidence have been presented in Courts.

Conclusion

Analysis of bite mark evidence has been assisting the judiciary to answer crucial questions about interactions between people at the scene of a crime for years. But currently, there is no agreement among forensic odontologists about the individuality (uniqueness) of the dentition and on the behaviour of human skin during and after biting. With the slow but rational enhancement of techniques along scientific lines like the DNA analysis, bite mark evidence can reinforce and expand its sound and logical basis.

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