Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1061
Short Communication/Letter To Editor

BITE MARKS – A BALANCED PERSPECTIVE

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ABSTRACT.

The article compliments the recently published manuscript titled "Bite Marks – A Vital Investigation in the Field of Forensic Medicine". It highlights the importance of bite mark analysis in forensic dentistry for solving crimes. Forensic odonatologists handle dental evidence, which is vital for law enforcement. Although bite marks have historically been used in criminal cases, doubts about their accuracy remain, highlighting the necessity for more uniform methods. Computer-assisted techniques have improved precision, yet obstacles persist in guaranteeing scientific validity and reliability. The President's Council of Advisors on Science and Technology stresses the significance of fundamental validity and standardized procedures. Historical cases show the importance of improving analysis techniques. Ultimately, bite mark evidence is essential in court but should be corroborated by other evidence to ensure accuracy and credibility, emphasizing the importance of cooperation for dependability and validity.

Keywords: *Bite Marks, Forensic-Pattern Match, Evidence Reliability*
Submitted: 2024-03-05 Accepted: 2024-04-15

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INTRODUCTION.

The recent manuscript with the title "Bite Marks – A Vital Investigation in the Field of Forensic Medicine" authored by Shunmugavelu and Kumar (1) has highlighted that analyzing bite marks is crucial in forensic dentistry, aiding in solving crimes and identifying persons involved, even in post-mortem cases. Forensic odontologists manage dental evidence significantly, greatly supporting law enforcement in criminal and civil trials, particularly in medicolegal settings. Shunmugavelu and Kumar (1) encourage collaboration with forensic pathologists, arguing that dental evidence is vital and trustworthy in autopsies.

Bite wounds, a prevalent type of human injury, have been used as tools and weapons in various historical contexts. These markings frequently appear in situations involving sexual assault, murder, and child abuse, and their evaluation can significantly impact the conviction of suspects. Bite marks may be present on both the victim and the assailant. Identifying individuals in severe assaults might be complicated by the appearance of many bite marks. Bite marks are unique because of tooth features, how the teeth come together, muscle activity, tooth positioning, and issues with the temporomandibular joint (2). *Bite marks* are imprints made by teeth, on their own, or combined with other mouth elements. Human bite marks are usually found on victims' skin or food items. Food markings are usually evident, although skin marks are typically less defined. These marks may emerge individually or in different places, occasionally presenting as several bites in a single spot. Historically, dental patterns helped identify victims or perpetrators because it was considered that the individual's teeth are unique. Human bite marks are typically described as oval or circular wounds.

Examining bite marks on inanimate objects and food items is more dependable than on skin. Many academic publications, technical notes, and case reports have explored different methods for identifying suspects in forensic contexts (3). The traditional method of analyzing bite marks on the victim's skin or flesh and objects and comparing them to the suspect's dentition using cast impressions is the most straightforward approach in the matching process. However, this comparison method is prone to various subjective factors and distortions that could lead to misidentification. Utilizing computer-assisted methodologies has improved the accuracy of morphological comparison, resulting in enhanced interpretation. Mistakes are usually minimized by utilizing software to assist in the comparison process, thereby improving the importance of bite mark analysis.

There are notable areas for improvement of bite mark analysis procedures based on the existing criteria for admitting evidence. The ongoing debate about bite mark analysis in courtrooms highlights the importance of a scientifically rigorous foundation for introducing this evidence in trials. It is essential to examine the clear display of established error rates carefully.

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The robustness of a method is shown not just by its success rates but also by how it deals with and acknowledges its potential error rates (3).

FORENSIC PATTERN-MATCHING TECHNIQUE.

The President's Council of Advisors on Science and Technology (PCAST) viewed bite mark analysis as a forensic pattern-matching technique that involves dental practitioners examining and comparing features to identify suspects (4). Moreover, the PCAST Report states that bite mark analysis needs foundational validity according to scientific standards and highlights the need for well-established criteria for measuring similarity (4). Concerns about the possibility of erroneous convictions linked to expert testimony utilizing these methods have been raised (5). Moreover, there is increasing concern regarding the need for more standardized scientific validity and reliability in pattern-matching techniques. This concern increases the likelihood of errors in interpreting evidence, bias, and the lack of reliable operating protocols. Scientific validity and dependability need each approach to be empirically tested to determine accurate error rates and the probability of correct matches.

CASE STUDY.

Wrongful convictions and indictments have happened in the US due to inaccurate bite mark analysis (6). In 1998, in the *State v. Shabangu murder* case in South Africa, dental experts examined a piece of cheese with distinct tooth marks (7). The High Court of South Africa dismissed the evidence as it only considered the correlation between the cheese bite marks and the suspect significant. The main concerns discussed were identifying frequent, unusual, and uncommon dental characteristics in specific groups, improving the study of bite mark patterns, and using metrics and microscopic analysis to identify unique features in bite marks. In another case, *State v. Nxele*, a ballistics expert was added to the bite mark team (8). This addition enabled examining a piece of cheese with distinct teeth marks using a DMC comparison microscope. This new technique improved the precision of forensic dental practitioners in presenting evidence. Cases like this prompt a re-evaluation of protocols and analysis methods in criminal cases. Technical notes and papers should utilize Case Reports to promote a beneficial synergy.

Although the methods for collecting bite mark evidence are widely accepted, and many forensic dentistry experts agree that bite markings can offer sufficient detail for identification, the testimony about bite marks has been criticized on multiple fronts. The main points of disagreement revolve around the techniques and standards employed for comparison. Errors could arise at every bite mark analysis stage, including overlay creation, photography, and tracing (9). Despite attempts to employ more objective techniques, the comparison process remains subjective. Beecher-Monas concluded that errors seem elevated but must be thoroughly quantified (9).

Moreover, forensic dental practitioners should be more prudent and revise their approaches to recognize the vulnerabilities in bite mark analysis. Forensic practitioners are advised to make more definitive efforts to establish the scientific basis of testing methods, including bite mark analysis. Dental practitioners must recognize that the accuracy of bite mark analysis is still very controversial. However, bite mark analysis in forensic science should be considered.

Evidence reliability is assessed in trials through cross-examination and opposing expert testimony, which can be used to challenge the original assertions (10,11). We propose that bite mark evidence should not be accepted as sole evidence in court but should be supported with other evidence. Forensic practitioners are advised to make more definitive efforts to establish the scientific basis of testing methods, including bite mark analysis. The court should act as a diligent protector of the evidence produced during trials.

CONCLUSION.

Despite progress, more instances in different regions have led to convictions based only on one forensic clue. Some convictions have been reversed because the forensic evidence lacked sufficient scientific support. Evidence using bite marks must be processed cautiously and this should rather be supported with other evidence in court.

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Publisher details.

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Website: https://sjpublisher.org
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