

Public Comments Received

on NISTIR 8352-DRAFT

Bitemark Analysis: A NIST Scientific Foundation Review

Published December 19, 2022

NISTIR 8352-DRAFT: Bitemark Analysis: *A NIST Scientific Foundation Review* was released for public comment on October 11, 2022. That draft document is available at <https://nvlpubs.nist.gov/nistpubs/ir/2022/NIST.IR.8352-draft.pdf>.

A public comment period was held from October 11, 2022, to December 12, 2022. This document lists all nine public comments in the chronological order in which they were received. Submitter email addresses and phone numbers have been redacted.

NIST hosted a webinar on October 27, 2022, to review the content of the draft report and address questions. A recording of the webinar can be found at <https://www.nist.gov/news-events/events/2022/10/webinar-bitemark-analysis-nist-scientific-foundation-review>. The 21 questions/comments received during the Q&A portion of the webinar are included in the public comments as PC4.

Public Comments for Bitemark Analysis Draft Report

PC#	Date	Submitter
PC1	October 17	Thomas Young
PC2	October 21	Kenneth Aschheim
PC3	October 24	Jules Epstein
PC4	October 27	Bitemark Webinar Q&A (21 comments received)
PC5	October 28	Carla Evans
PC6	November 3	Gil Sapir (letter also received)
PC7	November 9	Australasian College of Legal Medicine (Salem Altalie)
PC8	December 7	Denise Murmann
PC9	December 9	Innocence Project (Tebah Browne)

In addition, the following corrections were noted:

October 11: Judge Hervey regarding her affiliation with the Texas Court of Criminal Appeals

October 13: Robert Dorion regarding the spelling of his name in the CSAFE Thinkshop report

PC1

From: THOMAS YOUNG

Date: Mon, October 17, 2022 12:25 PM -0400

To: ScientificFoundationReviews <ScientificFoundationReviews@nist.gov>

Subject: Comment on "Bitemark Analysis: A NIST Scientific Foundation Review"

Thank you for the opportunity to comment on your very important work.

You properly and rightfully mention the words, "postulates" and "assumptions" in the work that forensic dental examiners have chosen to do with bite marks. You also properly and rightfully demonstrate the weaknesses in those "postulates" and "assumptions."

However, you do not address in your study something that is neither a postulate nor an assumption. That item is the Inferential Test (IT). The IT is:

One can be reasonably certain if witness accounts of the past are consistent or not consistent with physical evidence in the present, but one cannot reliably surmise past events from physical evidence unless there is only one plausible explanation for that evidence.

That statement is a theorem of deductive logic: one demonstrably always true, all the time, under all circumstances. I have documented the logical proof for the IT on my website, www.heartlandforensic.com. I have also written extensively about the IT since 2009 when I first discovered it, including it in a book and in a recent forensic science seminar. Both items were peer reviewed.

Applying the IT to bite mark analysis, if a dental examiner were to receive a verbatim witness account that included the act of biting, the examiner could examine the bite mark and validly conclude that the evidence is "consistent" with what was described by an eyewitness — "consistent" meaning "possible" or "could have happened as described" — or "not consistent" — "not possible" or "could not have happened as described."

Such a conclusion is deductively valid and even inductively strong. It is not "guesswork" but a conclusion where one can validly claim "a reasonable degree of dental certainty."

On the other hand, if a dental examiner were not to learn the verbatim accounts of eyewitnesses and were simply to include or exclude someone as a biter based solely on the comparison of bite molds and bite marks, then this would be "surmising past events from physical evidence," something that cannot be done reliably. Alleging someone as a biter without a comparison to what witnesses saw and heard would be simply offering a complex hypothesis that cannot be tested by typical scientific methods. It is "guesswork," and such guesswork about complex past events that can vary greatly from split second to split second is highly unreliable.

Your evaluations accept the premise that “surmising past events from physical evidence,” is something possible, possibly even reliable. What you should do, in my opinion, is consider the IT and test your conclusions using it in cases with witnessed past events.

Consider your “key takeaways” from what I have written:

#1.1: Anterior dental patterns do not need to be “unique” if they are compared to witness accounts of the past for consistency or inconsistency. Even bite marks with few individuating data items can be useful for a comparison to witness accounts.

#2.1: The entire dentition does not to be represented in a bite mark if the IT is followed.

#4.1: Population frequencies and “specific identifying characteristics” are not required for a mark to be compared to witness accounts for consistency (could have happened as witnessed) or inconsistency (could not have happened as witnessed).

#4.2: Your research has not addressed whether or not such variables of “skin elasticity, unevenness of biting surface, location of the bite, and movement of the biter and/or victim during the biting event” affect one’s ability to conclude according to the IT. Such research would be useful, but you were not aware of the IT.

#4.3: See 4.2, except applied to issues of “intra-individual variation.”

#4.4: See 4.2, except applied to cadaver-based research studies.

#4.5: We have no way of knowing about agreement of interpretation in light of the IT because this has not been tested.

#5.1: Consider this comment a call for additional data.

I’ll end here. If you desire any further information about the IT and it’s application to forensic casework, feel free to contact me. My contact information is at www.heartlandforensic.com.

Thomas W. Young, MD

PC2

From: Kenneth Aschheim

Sent: Friday, October 21, 2022 1:03 PM

To: ScientificFoundationReviews <ScientificFoundationReviews@nist.gov>

Subject: Comments on Bitemark Analysis: A NIST Scientific Foundation Review from the OSAC Forensic Odontology Subcommittee

NIST

On behalf of the OSAC Forensic Odontology Subcommittee, I have been asked to submit their editorial comments concerning the Scientific Foundation Review. Because of their role in publishing standards, they have decided not to make technical comments on the draft's contents. Instead, they will use the final NIST report and the public comments to assist them in future documents.

There were no objections within the subcommittee to submitting these concerns.

Please feel free to contact me if you have any questions.

Ken

Dr. Kenneth Aschheim
Assistant Chief Forensic Odontologist
Office of Chief Medical Examiner

The Organization of Scientific Area Committees (OSAC) for Forensic Science's Forensic Odontologist Subcommittee (FOS) would like to thank NIST for providing a comprehensive Scientific Foundation Review concerning bitemark analysis. As you know, the Subcommittee's mission is to draft guidelines and standards for forensic odontology using evidence-based studies. The final NIST report and the public comments will undoubtedly assist us in the future.

Because of our role in publishing standards, we have decided not to make technical comments on the draft's contents. However, we feel it is important to submit some editorial concerns with the current draft document. The FOS is concerned that the authors failed to follow NIST-coordinated OSAC guidelines concerning the use of OSAC registry-approved terminology designed to prevent misunderstandings in the target audience that includes "*the broader audience includes the organizations and individuals who comprise the justice system.*" We believe this report should align with the OSAC recommendation to prevent this confusion by using only approved terminology in all forensic documents.

The first concern is the definition of a bitemark, where there is a distinct difference between the OSAC registry-approved document (OSAC 2021-N-0030) and the definition provided in the draft.

Bitemark: *the pattern in a substance resulting from a bite (whether human or non-human). In food or wax, the pattern is more often visible as a result of indentations or impressions and occurs with sometimes little force from the biter (for example bitemarks left in wax or cheese). In skin, the pattern is seen as a vital response to the injury: through swelling, scraping (abrasion), bruising (contusion), or tearing (laceration) of the flesh. Depending on the force of the bite and the skin, the tissue may not show a response and therefore some bites may not leave a mark.*¹

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bitemark/bite mark - *physical alteration in a substrate caused by the contact of the biting surfaces of a tooth or teeth as a result of the forceful closure of the mouth*

OSAC 2021-N-0030, Terminology for a Suspected Pattern of Dental Origin (added April 5, 2022).

International Organization for Standardization (ISO) best practice for terms and definition states that the definition *shall* be written in such a form that it can replace the term in its context and should not take the form of or contain a requirement. The expansive definition not only follows the substitution requirement but needless includes recognition requirements. Therefore, although the issues raised in the definition may be valid and, in fact, are discussed elsewhere in the document, they are not a definition of the term. The OSAC-approved definition, which was submitted in 2021 and has been in the registry since April 2022, should have been used instead.

Because of this oversight, the second term, Bitemark Analysis, was incorrectly defined., Although not explicitly defined in document OSAC 2021-N-0030 (an oversight that the SDO will hopefully correct), the term analysis is defined within the OSAC lexicon of approved terms

Bitemark Analysis: *the examination of patterned marks left on a victim or object at a crime scene and comparing those marks with dental impressions from a person of interest.*¹

¹This report acknowledges that a victim may bite a perpetrator in the course of the attack, however, this report focuses on bites left on a victim and the process to identify the biter.

Analysis - The measurement of analyte and evaluation of data

OSAC Lexicon Accessed October 16, 2022

Grammatical convention would dictate that the *analysis* would occur on the *bitemark* and nothing else. Therefore, the Bitemark Analysis definition, which includes the expansive use of a "biter," is imprecise since it involves data, specifically the dentition, that is neither part of the OSAC-Registry-approved nor the NIST proposed draft definition. Moreover, the improper use of this term implies that other components of bitemark analysis, such as species characteristics (ex. human vs. non-human) and class characteristics (ex. child versus adult), and DNA sampling also do not have a scientific basis and are equally flawed. Again, this was not the intent of the draft document; however, it is easy to see that the improper use of the imprecise non-approved term in statements such as "*Forensic bitemark analysis lacks a sufficient scientific foundation.*" may give that impression. More appropriate scientific terms such as **Bitemark Recognition**, **Bitemark Source Attribution**, or, in even more laypersons' terms, **Bitemark Comparison** more accurately reflect the findings in the document. The Subcommittee wants to emphasize that the intent of this change is not to discredit the conclusion drawn by the paper but to prevent misunderstandings due to the use of non-approved terms

An additional concern is the imprecise use of the phrase *lack of support for human dentition being unique at the individual level*. As Bush et al. (2011a) stated, uniqueness cannot be proven but can only be disproven. As you stated, their paper outlines serious technological barriers concerning our ability to **discern** the uniqueness of individualization of human dentition for bitemark source attribution based on the commonly used techniques. However, although we may agree with this assumption, it fails to negate a fundamental law of physics, if you have two unique individuals and each has a dentition, you have two distinct dentitions. Therefore, the study's conclusion was not the lack of support for human dentition being *unique* at the individual level, but to highlight the inability of historical methodologies to distinguish individual characteristics. Although semantically, this appears to be a fine distinction, it implies an overly broad conclusion for the narrower scientific conclusion. In addition, in cases where the bitemark images are of sufficient evidentiary value and display distinctive class characteristics, classification at the class level requires a certain level of uniqueness to define the classes. Characteristics such as a child dentition versus an adult dentition could be ascertained because of that uniqueness and are especially important in cases where DNA sampling did not provide the needed answers.

The aspirational goal of the FOS is to utilize the concerns raised by documents such as the NIST Foundational Review as the basis for future proposed drafts. To address concerns such as recognizing suspected pattern injuries of dental origins, the FOS will attempt to set minimum standards for photographing, documenting, and collecting the data to ensure it is of sufficient evidentiary quality to perform any meaningful, evidence-based analysis. The goal of the FOS is to address the concern raised in the report:

While practitioners were generally compliant with evidence collection procedures advocated in the ABFO guidelines, the areas of photographic documentation as well as impression and excision of the bitemark site lacked consistent adherence and were susceptible to personal preferences of the examiner.

The FOS feels that unless minimum standards are created to ensure the adequacy of evidentiary data to perform any type of analysis, it will be impossible to determine if the interpretation of any characteristic of a specific bitemark can be performed consistently.

Further into the future, and only if a documentation standard gets approved, a future standard will attempt to **define class characteristics** unique to human dentition at various ages and differentiate them from other species and, if possible, from other types of injuries. The goal is to determine under ideal conditions if we can reach sufficient granularity in specific class characteristics within the dentition (not the bitemark) to make a generalized determination of species and distinguish between the primary and permanent dentition. The goal of the FOS is not only to prevent wrongful convictions, but also to preserve the rights of victims who have been assaulted and deprived of the right to utilize evidence that will support their claims of abuse.

In the past, overreaching terminology in the interpretation of data has led to wrongful convictions. We are concerned that the unintentional failure to include OSAC registry and Lexicon-approved terms and definitions could lead to a similar misinterpretation of the actual conclusion supported by this document. Therefore, we asked that editorial corrections be made in the final document that will conform to the terminology recommended by OSAC and better reflect the findings in the report.

Don't hesitate to contact the FOS if you would like some assistance in this process.

Dr. Kenneth Aschheim
Chair OSAC Forensic Odontology Subcommittee
On behalf of the Subcommittee

PC3

From: Jules M Epstein

Sent: Monday, October 24, 2022 3:21 PM

To: ScientificFoundationReviews <ScientificFoundationReviews@nist.gov>

Subject: NISTIR 8532-draft report on bitemark analysis

To whom it may concern:

Please accept this email as one of strong support for the NIST draft report on bitemark analysis. By way of background, I am an attorney with more than 44 years in criminal law; a law professor with more than 25 years teaching the law of Evidence; and a member of the National Commission on Forensic Science from 2013 through its completion in 2017.

The science is clear that the three conclusions of this report are accurate and not subject to reasonable disagreement. Those are: "First, human anterior 310 dental patterns have not been shown to be unique at the individual level. Second, those patterns are not accurately transferred to human skin consistently. Third, it has not been shown that defining characteristics of those patterns can be accurately analyzed to exclude or not exclude individuals as the source of a bitemark."

That this needs to be affirmed by the leading scientific standards organization in the United States is beyond question. Bitemark evidence continues to be offered in criminal trials across the United States. This means that it is also relied upon in the investigation stage, and relying on non-science [indeed, erroneous 'science'] can only lead to misdirection and the risk of wrongful arrest and conviction. The report also has particular importance in jurisdictions that apply the *Frye* standard of general acceptance as it demonstrates that there is not uniform or even wide agreement with the theories proffered by forensic odontologists and confirms that the relevant community is broader than just the practitioners themselves.

I close with a final and important concern is that of the risk of bias distorting judgments in this discipline. The report adverts to bias twice; I add here simply that the less data-based a discipline is, and the more subjective the measurement/decision becomes, the greater the risk that non-domain-related information and considerations will affect and alter judgments.

Thank you for considering these comments.

Professor Jules Epstein
Edward D. Ohlbaum Endowed Term Professor
Director of Advocacy Programs
Temple Beasley School of Law

PC4

Questions/Comments Received During October 27, 2022, Webinar on Bitemark Analysis Foundation Report

Event Date: October 27, 2022 – 01:00 PM to 03:00 PM

Posted Questions* with Time Received

*Names listed were self-created by attendees, thus some may be aliases

[01:25 PM]

Margaret Perkins asked: Is there any basis to claim that an oval or round bruise with central clearing but nothing that appears to be a tooth mark is in fact likely to be a bite mark, as opposed to an injury unrelated to bite marks?

[01:44 PM]

David A Wold DDS asked: The moderator first said they are only considering BMs on skin, then later went to skin and other substrates. Inconsistent. There also seems to be a loose use of bundling BM Analysis with injury analysis and a BM comparison phase if able to do so, in my opinion

[01:45 PM]

Chris Fabricant asked: Could you pls clarify the first comment, i.e., how it relates to bite mark evidence?

[01:51 PM]

John N asked: I am wondering why your report does not address the importance of the quality of evidentiary value contained in a particular bitemark. This issue of the quality of an individual bitemark "clouds" the issues of all three of the main take-aways from your report.

[02:07 PM]

John McDowell asked: Will the complete Powerpoint presentation be made available and, if so, when will it be available? Thanks

[02:09 PM]

Tahir Farid asked: The Uniqueness of bite mark needs unique Bite classification like Bite marks classification by Cameron and Sims and the degree of penetration.

If the Bite inside or outside the yellow tape, the collection of evidence will change as saliva DNA collection can make a totally of big difference.

[02:10 PM]

Tiffany Vollmer asked: Do you have any case examples that have been through the court system?

[02:10 PM]

John N asked: Concerning the uniqueness of the human dentition, your report does not address open vs. closed population. Especially dealing with bites on children.

[02:11 PM]

Mary Beth Hauptle asked: Are you familiar with the Standard for Medicolegal Death Investigation regarding evidence related to an injury in skin on scene?
After photographic documentation of the site, the Standard Practice is to swab the suspected injury site for DNA.

[02:11 PM]

Margaret Perkins asked: My understanding is that the courts routinely base decisions on previous decisions, rather than the science.

[02:16 PM]

Margaret Perkins asked: How will the document be disseminated and to what agencies?

[02:17 PM]

alan dorfman asked: I came in late. How large is the forensic bitemark community? how different in skill?

[02:18 PM]

John McDowell asked: Thank you for your good work on this topic. Does this "work product" not immediately become part of the public domain?

[02:18 PM]

Mary Beth Hauptle asked: I challenge the use of of the word "identify" on line 94 of the draft. Better to say "recognized", or observed.

[02:18 PM]

Tahir Farid asked: Do advancements in photography like multispectral imaging can reveal if there is fragments from dental materials like composite, taken into consideration?

[02:19 PM]

Tammi asked: Is there any certification required for Bite Mark analysis?

[02:19 PM]

Tammi asked: Do they take proficiencies?

[02:20 PM]

Maria Sahayaselvan asked: Did the report also look into the bite marks standards and guidelines from other jurisdictions as well other then ABFO?

[02:21 PM]

Karen Kafadar asked: Do you know approximately WHEN the FINAL (vs Draft) report will be available? (Apologies if you said this already). Thank you for the nice presentation.

[02:22 PM]

Mary Beth Hauptle asked: The use of the word “identify” or identification should be exclusively related to legal scientific means of learning the identity of a person. As follows they are 1. Fingerprint, 2. Dental comparison of radiographic antemortem records to the postmortem remains, and 3. DNA comparison.

[02:29 PM]

John N asked: Did your publication review follow accepted guidelines for meta-analysis? I don't see those elements reported anywhere.

PC5

----- Original Message -----

From: "Evans, Carla"

Date: Fri, October 28, 2022 8:29 AM -0400

To: ScientificFoundationReviews <ScientificFoundationReviews@nist.gov>

CC:

Subject: Bitemark Analysis - A NIST Scientific Foundation Review - comment

I listened to yesterday's webinar yesterday.

The draft of the Bitemark Analysis document mentions "a lack of population frequencies that indicate a degree of variation in dental features." That statement is misleading. Population data for basic mesio-distal and bucco-lingual measurements of teeth do exist in tables for hundreds of human populations from Africa, North America, Asia, South America, Australia, Oceania, Europe, and Middle East (see Human Adult Odontometrics - The study of variation in adult tooth size, by Julius A. Kiestler, Cambridge University Press, 1990). Metric and non-metric variations in tooth form are also described in two other books (Dental Anthropology by D.R. Brothwell, Pergamon Press, 1963; Dental Anthropology by Simon Hillson, Cambridge University Press, 1996). The published measurements are highly accurate, but the mean differences between groups are small and the ranges overlap. So, while population frequencies do exist for some traits, the metrics alone do not discriminate at the individual level. Non-metric variations, however, such as incisor shoveling, incisor winging, and tooth displacements may help to differentiate between people without implying uniqueness.

My suggestion is to change the "lack" sentence to something similar to "existing population frequencies of basic tooth measurements overlap and do not permit identification at the level of the individual."

The draft's lack of support for premise "1) human dentition is unique at the individual level" is overly simplistic because ultimately uniqueness based on shape, size, arch dimensions, surface irregularities and composition probably exists, but NOT at the degree of accuracy achieved when assessing bitemarks.

Carla A. Evans, DDS, DMSc
Clinical Professor of Orthodontics

PC6

From: Gil Sapir

Sent: Thursday, November 3, 2022 6:34 PM

Subject: bitemark book review - junk science in the american criminal justice system by fabricant

book review - junk science in the american criminal justice system by fabricant
bitemark evidence is addressed

Fabricant, M. Chris, Junk Science and the American Criminal Justice System, *Champion*, vol.46, no.8, Sept./Oct., 2022, p.53

book review attached

copy of book review sent to nist bitemark steering committee by e-mail or regular u.s. mail

PC7

From: Aclm (Australasian College of Legal Medicine)

Sent: Thursday, November 10, 2022 12:51 AM

To: ScientificFoundationReviews <ScientificFoundationReviews@nist.gov>

Cc: Salem Altalie

Subject: NIST Bitemark Analysis Review - Comments - Dr Salem Altalie - ACLM

To whom it may concern,

Please find attached comments on the NIST Bitemark Analysis Review, as provided by Dr Salem Altalie on behalf of the Australasian College of Legal Medicine.

We hope this feedback is useful. Please let us know if you have any questions.

Kind regards

Jayelle Conway

Administrative Officer



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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

Bitemark Analysis: A NIST Scientific Foundation Review **Draft Report**

**The following response is provided by Dr Salem Altalie,
Fellow of the Australasian College of Legal Medicine**

The National Institute of Standards and Technology (NIST) released a report on the use of bitemark analysis – Forensic Odontology. This "discipline" has experienced an unnecessary negative track record that focuses on bitemark analysis as solo evidence for criminal cases. Bitemark evidence is a type of trace evidence and contributes to shared evidential information. This cannot be generalized to label the evidence as bad science.

Bite marks on human skin may capture some details of a perpetrator's teeth characteristics and can be used as forensic evidence for correlation but not for an accusation. The court might consider it as tangible evidence or easily dismiss it.

Recording the bite mark description (Analysis and Interpretation - size, shape, location, etc) is an important step to process the evidence. There are two parts to this applied science that require a senior with a multi-specialty expert for the above-mentioned description points. Senior with multi-specialty experts refer to an expert having experience in forensic cases (working within the forensic evidence/medicine department) working along with other forensic teammates (DNA, FP, CSI). Secondly, the expert must prepare this evidence with high expertise in image editing (specialized digital tool) and have knowledge and skill in the physiology of the human body for decision-making.

A bite mark is similar to an "impression trace" like a shoe or tool mark in a crime scene and gives a possible indication of someone's presence with the victim only. A bite mark can't stand alone, it is a piece of combined evidence with DNA. Bitemarks' protocol or guidelines should reconsider how the objective evidence is reported to the court. Evidence material like bite marks from previous cases in the innocence project was treated as main evidence and became a turning point for their innocence.

Dr Salem Altalie, FACLM

PC8

From: Denise Murmann

Sent: Wednesday, December 7, 2022 10:40 AM

To: ScientificFoundationReviews <ScientificFoundationReviews@nist.gov>

Subject: Bite Mark Research Challenges

Dear NIST,

This is probably too late, and perhaps not germane to the discussion, but part of the reason the research is not sufficient in the field, is that it is not allowed.

As a board certified forensic odontologist, I have offered to have my parents make bite marks on my arms, to document the changes in tissue after a bite mark is made on living tissue, and then to see if it could truly be determined by the bite mark as to which parent made which mark. My siblings were prepared to have models taken of their teeth to add possible suspects.

Three different universities were contacted and all declined, as it was "unethical." I reached out to the editor of the Journal of Forensic Sciences to see if we had a team of forensic odontologists do the documentation, but not affiliated with a university, would they publish it? They would not. It is unethical.

The desire to do more research is there, but not sure how to get it accomplished.

Denise C. Murmann, DDS, D-ABFO

PC9

From: Tebah Browne

Sent: Friday, December 9, 2022 5:03 PM

To: ScientificFoundationReviews <ScientificFoundationReviews@nist.gov>

Subject: Public Comment response to "NIST IR 8352-DRAFT Bitemark Analysis: A NIST Scientific Foundation Review"

To whom it may concern,

Thank you for the opportunity to comment on "NIST IR 8352-DRAFT Bitemark Analysis: A NIST Scientific Foundation Review." The Innocence Project's public comments are attached here.

Best regards,
Tebah Browne

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Tebah Browne, MSFS

Forensic Science Policy Specialist

[Innocence Project](#)

Pronouns: She/Her/Hers

INNOCENCE PROJECT PUBLIC COMMENT ON**NIST IR 8352-DRAFT Bitemark Analysis: A NIST Scientific Foundation Review****December 9, 2022**

The Innocence Project is pleased to respond to the National Institute of Standards and Technology's (NIST) call for public comments regarding the Bitemark Analysis: *A NIST Scientific Foundation Review* (SFR). For 30 years, the Innocence Project has worked to exonerate the innocent and prevent wrongful convictions through systemic reform. As of 2021, in the United States alone, there have been a total of 29 exonerations and 7 wrongful indictments, where bite mark evidence was used in the original prosecution.¹ Those wrongful convictions have resulted in innocent people serving as long as 35 years in prison and a total of approximately 424 years of wrongful imprisonment.² Wrongful convictions not only corrupt the well-being and livelihood of the innocent but also weaken the public's trust in the criminal legal system and diminish the reliability and importance of forensic science.

In 2015, members of the Innocence Project and Dallas Public Defender's Office filed a complaint with the Texas Forensic Science Commission (TFSC) on behalf of their client, Steven Chaney.³ Chaney was imprisoned for nearly 30 years because of erroneous bitemark analysis. After reviewing the complaint and investigating the issue, TFSC concluded that the validity of bitemark analysis had not been established and recommended a moratorium on the use of bitemark comparison in Texas's criminal courts.⁴ As a sign of their concern with the use of bitemark evidence, TFSC encouraged other jurisdictions to conduct statewide reviews of bitemark comparison cases.⁵ The integrity of our legal system requires that all forensic methods possess a firm scientific foundation.⁶ Bitemark analysis has led to many wrongful convictions because it stands on a weak scientific foundation.⁷ The bitemark analysis SFR report explored

¹ Innocence Project, *Description of Bite Mark Exonerations*, https://innocenceproject.org/wp-content/uploads/2021/07/Description-of-bite-mark-exonerations-and-statistical-analysis_UPDATED-7.6.2021_DRAFT-1.pdf (last visited Nov 14, 2022).

² *Id.*

³ Michael C. Bowers, *Bite Mark Evidence*, in FORENSIC SCIENCE REFORM 137 (2017), <https://linkinghub.elsevier.com/retrieve/pii/B9780128027196000054> (last visited Nov 14, 2022).

⁴ BITE MARK CASE REVIEW REPORT, (2017), <https://www.txcourts.gov/media/1445768/bite-mark-review-report.pdf>; In a Landmark Decision, Texas Forensic Science Commission Issues Moratorium on the Use of Bite Mark Evidence, INNOCENCE PROJECT (2016), <https://innocenceproject.org/in-a-landmark-decision-texas-forensic-science-commission-issues-moratorium-on-the-use-of-bite-mark-evidence/> (last visited Nov 14, 2022).

⁵ BITE MARK CASE REVIEW REPORT, *supra* note 4.

⁶ J.G. Clement & S.A. Blackwell, *Is current bite mark analysis a misnomer?*, 201 FORENSIC SCI. INT. 33 (2010).

⁷ Michael J. Saks et al., *Forensic bitemark identification: weak foundations, exaggerated claims*, 3 J. LAW BIOSCI. 538 (2016).

whether the weakness of bitemark evidence is due to the nature of the evidence or whether inadequacies in current analysis and comparison methods are barriers to its scientific rigor.

Importance of this Report

The bitemark analysis SFR is an important tool for centralizing the mounting scientific concerns regarding this forensic field. The report accomplishes this by evaluating articles that critique and support bitemark analysis and investigates their scientific principles and methodological limitations. The report is limited to three primary postulates (i.e., uniqueness, transference, and interpretation) of the discipline. Nonetheless, it is an important start to investigating the validity of bitemark analysis. The Innocence Project respectfully offers comments that are intended to strengthen the report. In our comments, we focus on bitemark recognition and identification, the classification of bitemarks and influencing factors, literature clarification, the need for statistical methods, biting devices, and the need for human factors and bias research. However, it is important to acknowledge that proponents of bitemark analysis have not proven that the field can reliably recognize a skin lesion as a bitemark, determine if the supposed bite is from a human, or determine if the suspected biter is a child or an adult. Until those claims can be scientifically proven, the suggestion of a uniform classification system and statistical method are futile.

Comments

Bitemark Recognition and Identification

The scope of the bitemark report is clear. The report is solely investigating the uniqueness, transference, and interpretation postulates of bitemark analysis.⁸ However, those are not the only important propositions of the field. Bitemark analysts must first determine whether an injury is a bitemark and whether that bitemark is human.⁹ A former president of the American Board of Forensic Odontology insisted that bitemark analysis is useful for suspect elimination and determining if the mark originated from a human.¹⁰ There is limited research assessing the validity of this claim. Identifying an injury as a bitemark is complex and can be highly subjective, depending on the severity and location of the skin lesion.¹¹ The Freeman and Pretty study, referenced in the report draft, demonstrates that there is a lack of consensus among bitemark experts when determining if a pattern injury is a human bitemark.¹²

Additionally, bitemark analysts assert that they can differentiate between a bitemark from a child and an adult.¹³ However, research has shown that there is a difference of opinion between

⁸ KELLY SAUERWEIN ET AL., *Bitemark Analysis: A NIST Scientific Foundation Review*, NIST IR 8352 (2022), <https://nvlpubs.nist.gov/nistpubs/ir/2022/NIST.IR.8352-draft.pdf> (last visited Nov 14, 2022).

⁹ Richard Souvion & Leslie Haller, *Bite mark evidence: bite mark analysis is not the same as bite mark comparison or matching or identification*, 4 J. LAW BIOSCI. 617 (2017); I.A. Pretty & D. Sweet, *The scientific basis for human bitemark analyses – a critical review*, 41 SCI. JUSTICE 85 (2001).

¹⁰ Sara Reardon, *Faulty forensic science under fire: US panels aim to set standards for crime labs*, 505 NATURE 13 (2014).

¹¹ Anoop K. Verma, Sachil Kumar & Sandeep Bhattacharya, *Identification of a person with the help of bite mark analysis*, 3 J. ORAL BIOL. CRANIOFACIAL RES. 88 (2013).

¹² Adam J. Freeman, *Construct validity of Bitemark assessments using the ABFO decision tree*, <https://www.wsj.com/public/resources/documents/ConstructValidBMdecisiontreePRETTYFREEMAN.pdf> (last visited Nov 10, 2022).

¹³ Iain A. Pretty & David Sweet, *A paradigm shift in the analysis of bitemarks*, 201 FORENSIC SCI. INT. 38 (2010).

experts when determining whether an assumed biter is an adult or a child. Reesu and Brown conducted a study to assess if the opinions of forensic odontologists and individual odontologists were consistent.¹⁴ The participants were provided four bitemark case photographs and asked to determine if the skin injury was a bite, if the suspected bite was from a human, and if the potential human biter was a child or adult. Eight weeks later, they were provided the same photographs and asked to repeat the questionnaire. The researchers found that there was inconsistency in opinions between odontologists, and there were changes of opinions for individuals over time, regardless of experience level.

Recommendation:

- 1) Bitemark experts claim that they can accurately recognize and identify a bitemark, determine if the bitemark is from a human, and distinguish between bitemarks caused by a child and adult. The bitemark analysis report should examine this claim when investigating the validity of bitemark analysis.

The Classification of Bitemarks and Influencing Factors

If the above postulates of the field can be substantiated using accurate and reliable science, a classification system is needed for skin lesions that have been identified as bitemarks. Currently, there is no singular way to classify different types of bitemarks and this has led to confusion in the field. The use of a singular classification system or scale is important because it allows professionals to communicate the nature of the injury between themselves and allows injuries to be categorized using a common system for research and legal purposes.¹⁵ There are many published classification systems. Sheasby and MacDonald attempted to classify bitemarks based on degrees of distortion.¹⁶ They concluded that the degree of distortion affects arch shape and size. The authors recommend that size-matching techniques should only be used on bitemarks with minimal distortion. In 2007, Pretty offered a human bitemark severity and significance scale.¹⁷ According to this classification method, bitemarks with very obvious bruising and small lacerations or multiple areas of laceration but little bruising have high forensic significance and moderate severity. Whereas marks with complete tissue avulsion, have high severity and low forensic significance. This severity and significance scale was created to enable professionals to assess the forensic quality of bitemark.¹⁸ This scale was utilized to assess the degree of expert agreement in bitemark casework.¹⁹ There are a lot of inconsistencies in bitemark analysis, especially when it comes to expert witness testimony. The use of a verified classification system could aid in revealing inconsistencies and unifying the field. The current bitemark analysis SFR draft should include a discussion on bitemark classification and provide a key takeaway emphasizing the need for consistent terminology and categorization of bitemarks.

¹⁴ Gowri Vijay Reesu & Nathan Lee Brown, *Inconsistency in opinions of forensic odontologists when considering bite mark evidence*, 266 FORENSIC SCI. INT. 263 (2016).

¹⁵ Pretty and Sweet, *supra* note 13.

¹⁶ D.R. Sheasby & D.G. MacDonald, *A forensic classification of distortion in human bite marks*, 122 FORENSIC SCI. INT. 75 (2001).

¹⁷ Iain A. Pretty, *Development and Validation of a Human Bitemark Severity and Significance Scale*, 52 J. FORENSIC SCI. 687 (2007).

¹⁸ C. Michael Bowers & Iain A. Pretty, *Expert Disagreement in Bitemark Casework*, 54 J. FORENSIC SCI. 915 (2009).

¹⁹ *Id.*

Bitemarks are difficult to classify because of various influencing factors. The current draft of the bitemark analysis SFR report briefly mentions some of the factors that influence bitemark analysis. Influencing factors, such as skin elasticity, location of the bite, tissue damage, body composition, bite force, movement of victim, etc., affect the severity, shape, and size of the mark.²⁰ The report should explain, in addition to listing, how these influencing factors can affect the transference of an individual's dentition. A lack of bitemark analysis publications focusing on influencing factors reveals that there are major gaps in the literature.

Recommendation:

- 2) Include a discussion on bitemark classification.
- 3) Explain the effects of influencing factors and research studies that investigate or discuss these factors.

Literature Clarification

This report succeeds in providing useful studies that properly support the key takeaways and final conclusions. However, a more expansive discussion of the literature would strengthen its conclusions. Lines 718-723 highlights a meta-study with a sample size of over 1,200 articles.²¹ This report does not explain the criteria or parameters used to assess the articles and narrow the focus to only 13 articles or cite the methodology if it is explained elsewhere. There were also no in-text citations to help identify these sources.

Recommendations:

- 4) Briefly explain the criteria used to narrow the number of articles down to 13.
- 5) Provide in-text citations for the four articles claiming uniqueness and the 9 articles that found positive matches between dentitions.

Moreover, lines 829-832 provides an example of two highly controlled—and therefore meaningful—studies that resulted in high levels of inaccurate identifications.²² This report did not provide in-text citations for the study that found a 38% chance of a false positive.

Recommendations:

- 6) Provide in-text citation for the above article.

Need for Statistical Methods

Lines 735 to 736 of the report states that understanding the frequency of class characteristics in a given population is needed to assess the value of a conclusion of excluded or not excluded.²³ That information will potentially be stored in a frequency database. In general, forensic frequency databases should not be limited to class characteristics. According to ABFO, class characteristics are best used to distinguish between species, whereas individual characteristics

²⁰ J.C. Barbenel & J.H. Evans, *Bite Marks in Skin—Mechanical Factors*, 14 J. FORENSIC SCI. SOC. 235 (1974); Crime Museum, *Bite Marks*, <https://www.crimemuseum.org/crime-library/forensic-investigation/bite-marks/>.

²¹ SAUERWEIN ET AL., *supra* note 8.

²² *Id.*

²³ *Id.*

(i.e., arch and dental characteristics) are used to distinguish between individuals.²⁴ Bitemark analysis is not limited to species identification, ergo the development of a frequency database should include class and individual characteristics. Additionally, this section of the report should explicitly discuss the need for statistical methods. Once frequency databases are developed, a statistical method will be needed to evaluate the weight of the evidence. Without the goal of developing a statistical method to assess the value of bitemark evidence, understanding the frequency of class or individual characteristics and developing frequency databases lacks utility. However, prior to the development of a statistical method, the field must first prove that class and individual characteristics in dentitions can be reliably identified and transferred to skin.

Recommendations:

- 7) Change line 735-736 to “Understanding the frequency of class and individual characteristics...”
- 8) Add a discussion about the need for and lack of statistical methods for evidence evaluation.

Biting Devices

Some bitemark studies involve the use of biting devices.²⁵ These devices are utilized in bitemark studies that use pig skin or cadavers as representative models. The biting devices are used to ensure that a controlled force is applied to the skin model. As stated in the draft report, bite force is a factor that affects the degree of bitemark distortion.²⁶ Studies that utilize unchanging skin models and use biting devices produce results that are highly conservative and may overestimate the accuracy of the method. However, these studies still find inconsistencies between bitemarks from the same teeth model and examiners with different experience levels.²⁷ This report points out that even in highly controlled settings, there are high levels of inconsistency and inaccuracy, even without the inherent distortion and other factors impacting bite mark analysis in case work.²⁸ A discussion of biting devices will strengthen this conclusion and add to Key Takeaway #4.4.

Recommendations:

- 9) Add a paragraph, in 4.2, detailing the use of biting devices in bitemark research

²⁴ The American Board of Forensic Odontology, *ABFO Bitemark Methodology Standards and Guidelines*, <http://abfo.org/wp-content/uploads/2016/03/ABFO-Bitemark-Standards-03162016.pdf>.

²⁵ S. L. Avon & R. E. Wood, *Porcine skin as an in-vivo model for ageing of human bite marks*, 23 J. FORENSIC ODONTOSTOMATOL. 30 (2005); S.L. Avon et al., *Error rates in bite mark analysis in an in vivo animal model*, 201 FORENSIC SCI. INT. 45 (2010); Mary A. Bush et al., *Biomechanical Factors in Human Dermal Bitemarks in a Cadaver Model**, 54 J. FORENSIC SCI. 167 (2009).

²⁶ SAUERWEIN ET AL., *supra* note 8.

²⁷ Bush et al., *supra* note 25; Avon et al., *supra* note 25.

²⁸ SAUERWEIN ET AL., *supra* note 8.

Need for Human Factors and Bias Research

Bitemark comparison and interpretation methods involve a high degree of subjectivity that shrinks the credibility of the field.²⁹ The comparison procedures remain subjective, regardless of whether 2D or 3D technology is used to create comparison overlays.³⁰ The bitemark analysis SFR report should explore the subjective nature of bitemark comparison and interpretation and include a discussion on human factor and bias. There are many potential biasing factors in bitemark analysis.³¹ Forensic odontologists usually assist with or perform bitemark evidence collection. During this process, they meet and/or interact with victims and suspects. That interaction may trigger a wave of emotional cognitive input.³² Emotional influences can have drastic effects on decision making.³³ Some practitioners have a close relationship or communicate closely with law enforcement agencies, which can lead to cognitive bias.³⁴ This close communication renders a specific type of cognitive bias, i.e., confirmation bias. Confirmation bias intensifies when there is a desired outcome.³⁵ Additionally, the knowledge of contextual information, such as crime type, age of victim, gender of person of interest (POI) or victim, and race of POI, can influence interpretation and decision-making.³⁶ These potential biasing factors run the risk of erroneous matches and identifications. It is important to investigate if there is a *bias blind spot* in bitemark analysis. Bias blind spot is a psychological phenomenon that occurs when examiner's acknowledge bias in other fields but not their own and contextual effects go ignored.³⁷ Bias blind spot yields misguided interpretations, overconfidence, and erroneous results.³⁸

Recommendations:

- 10) Discuss human factors and bias in bitemark analysis.

Conclusion

We are grateful for NIST's leadership in the scientific foundation review program and recognize the extensive work that was undertaken to produce the report including an extensive literature review and a Thinkshop to obtain feedback from a diverse set of stakeholders. Thank you for

²⁹ STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD, (2009).

³⁰ Stella Martin-de-las-Heras & Daniel Tafur, *Validity of a dichotomous expert response in bitemark analysis using 3-D technology*, 51 SCI. JUSTICE 24 (2011).

³¹ Mark Page, Jane Taylor & Matt Blenkin, *Context Effects and Observer Bias-Implications for Forensic Odontology: CONTEXT EFFECTS AND OBSERVER BIAS*, 57 J. FORENSIC SCI. 108 (2012).

³² Mark Page, Jane Taylor & Matt Blenkin, *Reality bites—A ten-year retrospective analysis of bitemark casework in Australia*, 216 FORENSIC SCI. INT. 82 (2012).

³³ Itiel E. Dror et al., *When emotions get the better of us: the effect of contextual top-down processing on matching fingerprints*, 19 APPL. COGN. PSYCHOL. 799 (2005).

³⁴ Page, Taylor, and Blenkin, *supra* note 31.

³⁵ DANIEL EDGCUMBE, *Confirmation bias in decision making for fingerprints, DNA and eyewitness evidence cannot be explained by cognitive style or thinking dispositions.*, (2019), <https://osf.io/59tzd> (last visited Nov 14, 2022).

³⁶ Glinda S. Cooper & Vanessa Meterko, *Cognitive bias research in forensic science: A systematic review*, 297 FORENSIC SCI. INT. 35 (2019).

³⁷ Jeff Kukucka et al., *Cognitive bias and blindness: A global survey of forensic science examiners.*, 6 J. APPL. RES. MEM. COGN. 452 (2017); Page, Taylor, and Blenkin, *supra* note 31.

³⁸ Page, Taylor, and Blenkin, *supra* note 31.

your consideration of this feedback and for providing us the opportunity to comment on NIST IR 8352-DRAFT entitled *Bitemark Analysis: A NIST Scientific Foundation Review*. The Innocence Project appreciates your hard work and diligence. We look forward to the final report or future drafts.