

Epidermis and Enamel

Insights Into Gnawing Criticisms of Human Bitemark Evidence

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Abstract: Critics describe forensic dentists' management of bitemark evidence as junk science with poor sensitivity and specificity and state that linkages to a biter are unfounded. Those vocal critics, supported by certain media, characterize odontologists' previous errors as egregious and petition government agencies to render bitemark evidence inadmissible. Odontologists acknowledge that some practitioners have made past mistakes. However, it does not logically follow that the errors of a few identify a systemic failure of bitemark analysis. Scrutiny of the contentious cases shows that most occurred 20 to 40 years ago. Since then, research has been ongoing and more conservative guidelines, standards, and terminology have been adopted so that past errors are no longer reflective of current safeguards. The authors recommend a comprehensive root analysis of problem cases to be used to determine all the factors that contributed to those previous problems. The legal community also shares responsibility for some of the past erroneous convictions. Currently, most proffered bitemark cases referred to odontologists do not reach courts because those forensic dentists dismiss them as unacceptable or insufficient for analysis. Most bitemark evidence cases have been properly managed by odontologists. Bitemark evidence and testimony remain relevant and have made significant contributions in the justice system.

Key Words: odontology, forensic science, bite, evidence, bite mark, bitemark

In addition to human identification work in individual and multiple fatality cases, age assessment activities that assist in immigration and human trafficking cases, and the expertise to recognize and intervene in human abuse cases, forensic dentists (ie, odontologists) are sometimes asked to analyze patterns or patterned injuries that may be bitemarks. Reports of errors made by odontologists in bitemark cases in the 1980s and 1990s have been the recent focus of aggressive and disparaging criticisms.¹⁻³ The critics have been persuasive through forcefulness and repetition. Some journalists have been enlisted to further bolster critics' arguments and influence others to believe all bitemark analysis is without merit. Those influenced include the public, some governmental agencies, and members of the legal profession. The critics refer to issues related to bitemark evidence in the 2009 National Academy of Sciences report.⁴ Those issues have been widely reported and debated. However, the valid issues raised in the report have been largely addressed by organized forensic odontology. Bitemark evidence critics ignore the progress made by changes in standards, terminology, and the steps to inhibit bias.

As members of the forensic odontology community, the authors acknowledge that mistakes have been made in the past. However, analysis of the facts and contexts of the problem cases indicate that many other factors were also at play. An assessment of the issues, a background context, a summary of actions taken, and additional proposed solutions are presented here.

Wrongful convictions are dreadful occurrences both for those convicted and for the justice system, and they leave the actual wrongdoer free potentially to offend again. When bitemark evidence is connected

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to a wrongful conviction, forensic odontologists are deeply concerned and motivated to work to prevent future failures, particularly if the cause was even partially from erroneous or misleading testimony. As a result, odontologists who deal routinely with bitemark evidence and understand its limitations have adopted a conservative approach, including developing quality assurance procedures to limit potential biases and to eliminate false or exaggerated conclusions.⁵ Understanding the causes and attempting to clarify where, how, and why the wrongful convictions occurred is necessary to be able to take measures to reduce the likelihood of such failures from happening again.

THE CRITICS

Critics allege that odontologists misstate the uniqueness of the human dentition,⁶ and underestimate or ignore the unpredictable distortions of tooth marks on skin.⁴ Because of these observations, the critics characterize bitemark evidence as unreliable with poor sensitivity and specificity. They proclaim that all conclusions drawn from it must therefore be unfounded.⁷

The critics include some individuals from the Innocence Project, Inc and its affiliates in the innocence network (hereafter referred to as the Innocence Project [IP]), some members of the media, some but not all criminal defense attorneys, and some from within forensic science and forensic odontology. Most of the comments expressed by critics against expert opinions in bitemark evidence disparage the discipline to the point that a reasonable person might be convinced to distrust or totally disregard all opinions and conclusions of all members of the discipline. Interestingly, some trial attorneys from the IP may stand to gain financially from reviewing various cases being conducted ostensibly to determine if forensic methods are questionable, unreliable, or have resulted in wrongful convictions.⁸ This concern raises questions of potential conflicts of interest at best and the likelihood of an agenda-driven disingenuous attack at worst.

The IP, a major critic, reports that 351 persons have been exonerated using DNA evidence.⁹ However, only a small fraction of these cases included bitemark evidence. The IP variously reports that 27 or 28 cases, approximately 8% of their total, included bitemark evidence and resulted in later exonerations. However, not all of these cases were actual exonerations and not all of the exonerations were based on DNA. Some were exonerated at least partially based on the postconviction work of specialist odontologists with extensive bitemark experience unrelated to the IP¹⁰⁻¹² or by dentists who were specifically sought out by the IP for assistance. From this, the value of odontologists' testimony seems to be understood and appreciated. On one hand, the IP attorneys criticize the evidence and the specialists, whereas on the other hand they choose to use bitemark specialists.

The IP reported that about half of the cases involved the use of what it labeled as improper or nonvalidated forensic science.¹³ Topping their list of problem disciplines was serology, followed by microscopic and toxicological hair analysis, and forensic biology (ie, DNA evidence), which together accounted for approximately 55% of all wrongful convictions.¹³ It is remarkable that the IP continues to aggressively focus on bitemark evidence and obsessively seeks to eliminate it from United States courtrooms when based on its own statistics it is much more likely that a trial with DNA evidence will result in a wrongful conviction and subsequent exoneration than a trial with bitemark evidence.

The 27 wrongful conviction cases frequently reported in the media as of August 2017 included the cases of 7 individuals who were not wrongfully convicted at all. These 7 persons were investigated or accused but never went to trial precluding the possibility of either rightful or wrongful conviction.¹⁴

AN ODONTOLOGY RESPONSE

Forensic odontology, like clinical dentistry and clinical medicine is an applied science. It derives from well-founded maxims that evolve over time as more knowledge is gained. In applied science, opinions are formed by humans and are subject to potential human error. Decision making is a cognitive process subject to cognitive (observer effect) bias. This is unintentional and outside of awareness.¹⁵ Most disciplines in forensic sciences and medicine are vulnerable to this bias, yet the courts accept and rely on opinion testimony from witnesses deemed to possess adequate knowledge, skill, training, and experience. When a competent and responsible forensic odontologist offers an opinion at trial, it is just that. It is an opinion drawn from accumulated knowledge and experience with adherence to accepted current principles. Just as odontologists should not follow 30-year-old standards, they should not be judged today on previous noncurrent standards. Many of the wrongful conviction bitemark cases were analyzed using lower quality and sometimes unscaled autopsy and/or crime scene photographs.¹⁶ Reliance upon low-quality photographic evidence as the sole basis of bitemark evidence analysis and comparison would simply not be tolerated today.

As with all life sciences, forensic odontology is self-correcting; as problems are encountered, they are addressed. Even before the criticisms about erroneous convictions involving bitemark evidence became publicly known, discipline leaders recognized the need to modify policies and procedures, standards, and guidelines. If some critics of bitemarks had conducted their research without preconception, they likely would have discovered that many of the wrongful convictions featured departures from the accepted standards of practice that existed at the time.⁴ Forensic odontology training and the literature today promote procedures designed to prevent the errors of the past.

Means for improving reliability of bitemark analysis methods and formulating opinions are being assessed.^{17,18} When methods or techniques that increase reliability are found and validated, they are incorporated as appropriate. The American Board of Forensic Odontology (ABFO) has taken the lead role in this. The ABFO leaders are committed to ongoing discussion to promote appropriate evolution of the field. Included in this transition is the development of bitemark proficiency examinations for individual odontologists after board certification, producing new and more robust bitemark guidelines, requiring ongoing recertification of odontologists, and recommending independent verification of conclusions by a qualified colleague.

Regarding criticisms of the uniqueness of the dentition, logic holds that the dentition is unique on a molecular level and recent 3-dimensional research at the macrolevel has provided evidence that the surfaces of the clinical crowns of human teeth appear to be unique as well, at least in the populations studied so far.¹⁹ However, uniqueness may be moot, as the real issue centers around how much detail of the dentition is transferred or not transferred to the bitemark. The questions then become: (a) how dependable and distinctive is the information that is present in the bitemark and (b) how distinctive are the dentitions of the suspected biters? These questions are not new. Odontologists understand the similarities of dentitions, that the skin is not always dependable as an accurate recording substrate, and that during the dynamics of biting unpredictable distortions can occur. Many studies both by odontologists and nonodontologists support this.²⁰⁻²² Rather than adopting the premise that bitemarks are unique, experienced odontologists consider that many dentitions can produce similar patterns and that some bite patterns do not contain sufficient information to indicate any relationship to any specific individual.

This explains why odontologists do not continue analysis in most cases they initially evaluate and why so few cases with bitemark evidence reach the courts. The ABFO-certified forensic odontologists who follow the ABFO Standards and Guidelines are qualified to diagnose human bite injuries, compare those injuries with dentitions that may or may not have caused them, and express an opinion. There is no other group of individuals similarly qualified to complete bitemark analyses and comparisons.

The ABFO through its standards and guidelines no longer condones positive identification of a suspect dentition to a bitemark. Nevertheless, in selected cases where distinctive features are seen in a bitemark and are reflected in a proffered distinctive dentition, a relationship can sometimes be recognized and reported following established standards. As for the specificity and sensitivity of bitemark evidence, it must be recognized by odontologists and members of the justice system that a collective sensitivity and specificity can never be determined. First, there is no appropriate criterion standard. Second, odontologists, as humans, will not form opinions uniformly. Such is the nature of all opinion testimony in applied science and is the rationale for courts allowing opposing experts. Nonetheless, forensic odontology standards and guidelines can impact sensitivity, reduce false positives by helping to clarify which cases should or should not be analyzed while promoting consistent and appropriate terminology, and adding blinding steps for investigators to inhibit bias.

Accreditation is important. The Forensic Specialties Accreditation Board (FSAB) accredits the ABFO. The FSAB was established in 2000 seeking to advance the reliability and validity of forensic evidence through accreditation standards for organizations that certify forensic specialists. Referencing and applying several International Organization of Standardization/the International Electrotechnical Commission (ISO/IEC) standards plus their own forensic discipline standards, the FSAB critically evaluates credentialing bodies, including the ABFO, to improve the policies and standardize the administration of organizations and boards. The FSAB is guided by ISO/IEC Standard 17011:2004 and assesses certifying bodies to ISO/IEC Standard 17024:2012, including making assessments of the rigor of the organizations' certifying examinations, competency determinations, certification processes, and professional standards. It also addresses questions relating to proficiency and recertification testing of individual specialists. At present, the ABFO has FSAB reaccreditation status for 2013 to 2018 and has successfully completed the rigorous FSAB reaccreditation process for reaccreditation status from 2018 to 2023.

This year, the ABFO has taken additional steps following its mandated internal policies to update and renew the standards, guidelines, and best practices that impact each odontologist's approach to bitemark casework. These recently approved and revised standards and guidelines will continue to embrace the concepts of conservatism and the prerequisite that very high-quality evidence be available to complete blinded analyses, comparisons, and testing; they are geared toward establishing reasoned and well-structured conclusions.²³

Both the American Academy of Forensic Sciences and the ABFO are committed to the highest ethical standards. After full evaluation and substantiation of any ethical complaint, adverse determinations can lead to censure, suspension, or withdrawal of board certification quite separately from actions taken by the AAFS.

A SHARED RESPONSIBILITY

Odontologists and Odontology Organizations

Justifiable criticisms have been leveled against odontologists who misidentified bite perpetrators. Most certified forensic

odontologists are appropriately concerned about these past errors but do not agree that they represent a global indictment of bitemark testimony. The odontologists cited in wrongful conviction cases form a small subset of the overall discipline. Their methods and conclusions in many cases significantly deviated from the established boundaries in place at the time. Of the 27 cited cases, one odontologist was involved in 5 cases, another odontologist was involved in 4 cases, and 6 others were involved in 2 cases. In total, 8 odontologists contributed to 21 of those investigations, accusations, or convictions.¹⁴ In every forensic discipline whose practitioners testify in criminal or civil proceedings, there will likely be some "rogue" experts. Certifying bodies can inhibit their invalid or unreliable testimony by establishing and continually updating standards and guidelines and holding accountable their certified specialists. The ABFO can and has censured and suspended specialists and can withdraw the certification of those who do not adhere to the standards and guidelines or violate ethics provisions.

The 27 cases cannot be dismissed, and odontologists and the ABFO have evolved as a result of these issues.²⁴ The forensic community, the legal system, and governmental agencies must be apprised of unbalanced reporting in the media and that skewed exaggerations by critics generally underplay this evolution. When the contentious cases are viewed in light of hundreds of court cases that have not been implicated in wrongdoing and thousands of others that have been rejected by odontologists as unsuitable for analysis, the "junk science" moniker applied to bitemark evidence analysis is inappropriate.

The Legal Community

Just as organized forensic odontology has responded to past errors made by members, the legal community must acknowledge their roles in wrongful convictions. In some of the contentious bitemark cases, the responsibility of the legal community seems equal or greater.

The authors submit that the cases that have been characterized as wrongful convictions involving bitemark evidence also included factors unrelated to bitemark evidence. In those cases, 1 or more of these 14 factors influenced the convictions:

1. Erroneous eyewitness accounts²⁵
2. False confessions
3. Ignoring or failing to analyze physical evidence²⁶
4. Improper analysis of physical evidence or falsifying physical evidence results²⁷
5. Improper law enforcement practices²⁸
6. Improper actions of prosecution attorneys²⁹
7. Improper actions of defense attorneys³⁰
8. Failure of the defense to obtain the services of a forensic odontology expert³¹
9. Failure of the defense to use their forensic odontology expert witness at trial³²
10. Ineffective assistance of counsel³²
11. Ineffective qualification of an expert witness at voir dire
12. Official misconduct
13. Erroneous identification by victim
14. False jailhouse or other informant evidence or testimony.

Table 1 summarizes the other factors influencing the convictions of 21 individuals. Nineteen cases are listed because in 2 cases 2 individuals were codefendants. Factors influencing convictions are identified by number keyed to the factors 1 to 14 listed above.

TABLE 1. A Summary of the Factors Influencing the Convictions of 21 Individuals in 19 Cases With 2 Individuals as Codefendants in 2 Cases

Year of Crime	Defendant State	Convicted Year	Odontology Factors	Other Factors (Nonodontology)
1 1982	Harward, Keith A. Virginia	Murder, rape 1983	Two prosecution odontologists* testified Harward made the bitemarks. Two defense dentists† consulted agreed with prosecution odontologists. Another dentist† reviewed and excluded 1000 suspects including Harward.	Ignored or failed to analyze physical evidence (3), improper physical evidence procedure (4)
2 1984	Stinson, Robert Lee Wisconsin	Murder, rape 1985	Two prosecution odontologists* definitively linked Stinson to multiple bitemarks. A defense dentist† was retained but not called at trial. Six odontologists* working pro bono for the IP later excluded Stinson.	Improper law enforcement practices (5), defense failure or strategy (9), official misconduct (12)
3 1985	Wilhoit, Gregory Oklahoma	Murder 1987	Two prosecution dentists† overstated opinions linking Wilhoit to bite evidence and used unsupported bacterial evidence. Defense odontologist* retained but not called at trial. Eleven odontologists* working independently and pro bono excluded Wilhoit postconviction.	Improper physical evidence procedure (4), defense failure or strategy (9), ineffective assistance of counsel (10)
4 1986	Starks, Bennie Illinois	Sexual assault 1986	Two prosecution dentists† testified Starks made a bitemark. No defense odontologist* testified at trial. Two odontologists* working pro bono for the IP challenged both the bitemark analysis and linkage opinions at appeal.	Improper physical evidence procedure (4), defense failure or strategy (8), inadequate expert qualification (11)
5 1986	Washington, Calvin E. Texas	Murder, rape 1987	Prosecution odontologist* linked bites not to Washington but to another defendant (see 6) and excluded Washington. No defense odontologist testified at trial.	Improper law enforcement practices (5), improper prosecution actions (6), defense failure or strategy (8), ineffective assistance of counsel (10)
6 1986	Williams, Joe Sydney Texas	Murder, rape 1987	Prosecution odontologist* testified that Williams “likely made bites.” Defense odontologist* excluded Williams.	Improper law enforcement practices (5), improper prosecution actions (6), ineffective assistance of counsel (10)
7 1986	Jackson, Willie Louisiana	Sexual assault 1989	Prosecution dentist† testified that Jackson made the bitemark. There was no defense odontologist.* Postconviction odontologist* concluded the bitemarks were from Willie Jackson's brother Milton.	Erroneous eyewitness identification (1), improper physical evidence procedure (4), defense failure or strategy (8), ineffective assistance of counsel (10), erroneous identification by victim (13)
8 1987	Chaney, Steven Mark Texas	Murder 1989	Two prosecution odontologists* linked Chaney to bitemarks. One of them made unsupported “one in a million” statistical statement. Defense odontologist* testified the accused “could not be wholly excluded.”	Improper physical evidence procedure (4), improper prosecution actions (6), false informant evidence or testimony (14)
9 1990	Brooks, Levon Mississippi	Murder, rape 1992	Prosecution odontologist* testified that Brooks made the bitemark on victim. Defense odontologist* testified he could not exclude Brooks noting he was not given Brook's lower dental cast.	Erroneous eyewitness identification (1), ignored or failed to analyze physical evidence (3), improper law enforcement practices (5), official misconduct (12)
10 1990	Young, Dan and Hill, Harold Illinois	Murder, rape 1994	Prosecution odontologist* linked bites to both Hill and Young. No defense odontologist testified at trial. One postconviction odontologist* reported bitemark evidence insufficient for comparison.	False confession (2), ignored or failed to analyze physical evidence (3), improper law enforcement practices (5), defense failure or strategy (8), official misconduct (12)
11 1990	Cristini, Michael and Moldowan, Jeffrey Michigan	Kidnapping, rape, attempted murder 1991	Two prosecution odontologists* testified both men bit the victim. One later recanted describing the other as coercing, misleading and giving false statements. No defense odontologist testified at 1991 trial. Both men excluded by 2 postconviction odontologists.*	Defense failure or strategy (8), erroneous identification by victim (13)

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TABLE 1. (Continued)

Year of Crime	Defendant State	Convicted Year	Odontology Factors	Other Factors (Nonodontology)
12 1991	Keko, Anthony Louisiana	Murder 1993	Prosecution odontologist* used UV light on body exhumed after 14 mo to identify nonvisible bitemarks and testified that Keko made the marks. He failed to disclose that he was under ethics charges during trial. Two defense odontologists* testified at trial.	Improper prosecution actions (6), official misconduct (12)
13 1991	Krone, Ray Arizona	Murder, kidnapping 1992	Two prosecution odontologists* definitively linked Krone to bites, whereas a third excluded Krone. The prosecution did not inform the defense of the exclusion. A defense dentist† was not called upon to testify at the original trial. Four defense odontologists* testified at retrial.	Ignored or failed to analyze physical evidence (3), improper physical evidence procedure (4), improper law enforcement practices (5), improper prosecution actions (6), defense failure or strategy (8), official misconduct (12),
14 1991	Brown, Roy New York	Murder 1992	Prosecution odontologist* testified 7 bitemarks “entirely consistent” with Brown. Prosecution failed to disclose to defense that another odontologist* excluded Brown. Defense odontologist* testified.	Improper prosecution actions (6), official misconduct (12), false informant evidence or testimony (14)
15 1992	Brewer, Kennedy Mississippi	Murder, rape 1995	Prosecution odontologist* testified while suspended from ABFO that Brewer “indeed and without doubt” made 19 bitemarks with 2 upper teeth only on victim. Defense odontologist* testified that marks were not human bitemarks.	Improper law enforcement practices (5), improper prosecution actions (6), official misconduct (12)
16 1993	Richards, William J. California	Murder 1997	Prosecution odontologist* testified Richards made the bitemark on victim. Defense odontologist* testified evidence was nonspecific and consistent with Richards and multiple foils. Prosecution odontologist* later recanted original testimony.	Ignored or failed to analyze physical evidence (3), improper physical evidence procedure (4), improper law enforcement practices (5)
17 1994	Richardson, Gerard New Jersey	Murder 1995	Prosecution odontologist* testified “this mark was made by Gerard Richardson,” adding “there is no question in my mind.” Defense odontologist* testified Richardson did not make the bitemark.	Ignored or failed to analyze physical evidence (3)
18 1997	O'Donnell, James New York	Sexual assault 1998	Prosecution odontologist* testified “. . . it is possible that the defendant made the bite mark. I could not rule him out. But I could also not say that he is the only one that could have done it.” No defense odontologist at trial.	Erroneous eyewitness identification (1), ignored or failed to analyze physical evidence (3), defense failure or strategy (8), official misconduct (12)
19 2001	Weimer, Crystal Dawn Pennsylvania	Murder 2006	Prosecution dentist‡ exaggerated his credentials. Testified that Weimer made the bitemark 7–10 min before victim's death. Defense odontologist* could not exclude or include Weimer or anyone as evidence was insufficient. Defense odontologist did not testify.	Erroneous eyewitness identification (1), false confession (2), improper law enforcement practices (5), defense failure or strategy (8), official misconduct (12)

Factors influencing convictions are number keyed to the factors listed in the text.

*Odontologist — board certified by ABFO or equivalently trained and experienced.

†Dentist — not board certified, not equivalently trained and experienced.

‡Dentist who later became board certified by ABFO.

Finally, and crucially, is the matter of who actually makes the determination of whether a defendant is guilty or not guilty. All convictions, including those that later are shown to be wrongful convictions, are determinations made by a judge or jury based upon the evidence and how it was presented at trial.

The legal community has an obligation to safeguard against invalid and unreliable testimony. The obligation to provide adequate legal representation of defendants should lead attorneys toward engaging in rigorous qualification of experts, and encouraging the involvement of those that seek independent verification of expert opinions. Judges should take steps to improve their

gatekeeping skills and engage in training to improve their understanding of forensic evidence that they admit or exclude. Surveys of exoneration cases indicate that several cases involved either non-specialists, nonforensic specialists, or noncertified forensic dentists who nevertheless were qualified by the court as an expert witness in bitemark evidence and who gave highly specialized opinions. Incredibly, some witnesses have been qualified as bitemark experts having never completed an actual bitemark case. How this lack of knowledge, training, and experience went unchallenged or how it was challenged yet the witness was still deemed to be qualified to present opinion evidence should be profoundly worrisome to all.

Wrongful Conviction Responsibility Shared

In an extensive study by Gould et al³³ in 2012 concerning wrongful and near miss convictions, forensic error was 1 among 10 contributing causes listed, including the negative effect of forensic testimony errors. Mistaken eyewitness identifications (75%), false confessions (14%–25%), perjured informant testimony (snitches) (15%), prosecutorial errors (42%), and inadequate defense (bad lawyering) were contributing causes. No percentage was quoted for bad lawyering, but it was reportedly the biggest factor in capital cases in a Columbia University study.³⁴ Gould et al³³ stressed that, because these factors and others were often shared in near miss and erroneous conviction cases, it was incorrect to call them causes when they may be merely correlates. The 10 statistically significant variables listed by Gould et al³³ are as follows:

- State death penalty
- Age of defendant
- Criminal history of defendant
- Strength of prosecution case
- Intentional misidentification
- Culture forensic evidence error
- Prosecution withheld evidence (Brady violations)
- Lying by noneyewitness
- Strength of defense case
- Defendant offered family witness

They summarized their findings as follows³³:

“...our qualitative review of the cases reveals how the statistically significant factors are connected and exacerbated by tunnel vision, which prevents the system from self-correcting once an error is made. In fact, tunnel vision provides a useful framework for understanding the larger system-wide failure that separates erroneous convictions from near misses.”

“In addition, our results suggest that there should be greater emphasis at all levels and on all sides of the criminal justice system, including police, prosecutors, defense attorneys and judges, to analyze and learn from past mistakes before they result in serious miscarriages of justice.”

Three additional issues that were background influences or interrelated factors included race, inadequate postconviction remedies, and the role of the media.

A CASE STUDY: TFSC VERSUS BITEMARK EVIDENCE

The Texas Forensic Science Commission (TFSC) was established in 2005 to investigate complaints in relation to accredited crime laboratories. The scope of the commission was broadened by 2013 and later legislation increasing the TFSC's influence and power. The Texas governor appoints 9 commissioners to serve staggered 2-year terms and they can be reappointed. Two must have forensic science experience, 1 must be a prosecuting attorney, 1 must be a defense attorney, and the remainder must be in varying roles at 1 of 5 Texas universities. The governor designates a presiding officer or chair. The TFSC was not granted funding until late 2007. These funds are granted by state authorities and involve expenditure of taxpayer dollars.

A review of the earliest posted minutes from TFSC meetings reveals that representatives of the IP attended at least the first 7 organizational meetings in 2007 and 2008. According to those minutes, IP representatives participated in the meetings; assisted

with the organization, process development, and integration of national efforts; and contributed to discussions on decisions and standards for what the TFSC will elect to investigate. Discussions about the IP assisting the TFSC to apply for a federal grant also occurred.³⁵

In 2015, the same IP that participated in the organization, development, and decisions for what the TFSC would elect to investigate filed a complaint to the commission regarding bitemark testimony in a 1987 murder trial. The complaint cited multiple factors but focused on a forensic odontologist's statistical statement during testimony that there was a “[o]ne to a million” chance that someone other than the defendant could have left the bitemark. This statement was clearly unsupportable and did not follow 1987 ABFO Guidelines. After the complaint, the TFSC formed an investigative panel to assess the accusations. In April 2016, the TFSC recommended that bitemark comparisons not be admitted in criminal cases in Texas unless and until the following were established:

1. Criteria for identifying when a patterned injury constitutes a human bitemark
2. Criteria for identifying when a human bitemark was made by an adult versus a child
3. Rigorous and appropriately validated proficiency testing using the above criteria
4. A collaborative plan for case review, including a multidisciplinary team of forensic odontologists and attorneys.

To address item 4 above, a group of 4 ABFO-certified odontologists, 2 district attorneys, a public defender, and a criminal defense attorney were appointed to a TFSC Bite Mark Case Review Panel. To date, the panel has screened 30 cases and reviewed in some detail 24 cases that include bitemark evidence. The TFSC had “prescreened” 6 of the cases. The Bite Mark Case Review Panel has not yet reviewed those 6 cases, although 1, the case that was the subject of the IP's 2015 complaint to the TFSC, is included in those 6 cases.

It is ironic that the commission had recommended that bitemark evidence not be admitted in criminal courts, but counterintuitively determined that it was appropriate for it to use certified forensic odontologists and attorneys working together to assess previous criminal convictions based at least in part on bitemark evidence. If these dental and legal practitioners were deemed to be capable of making potentially life-altering determinations on behalf of the commission, and used public funds to do so, this suggests that the TFSC considers bitemark evidence expertise to have merit.

This leads to other troubling questions too. Did the TFSC rebuke bitemark evidence but then seek odontologists' opinions and use those opinions to take critical actions when it suited the commission's purposes? Was the TFSC unduly influenced by an activist special interest group? Did the commission start its deliberations with a preconception that bitemark evidence should not be admissible? Did it then seek to support that premise by emphasizing things that were favorable and persuasive to that position while specifically limiting evidence and arguments that were not?

Forensic pathologists have led the TFSC before, during, and since the bitemark evidence hearings. They enjoy specific exemption from oversight of their autopsy-related work by the commission they lead. In fact, the TFSC Complaint Form includes this admonition: “Please be advised that if you submit a complaint regarding the results of an autopsy, it is highly likely your complaint will be dismissed.”³⁶ Although forensic pathology fits the Texas

Criminal Code definition of “forensic analysis” at least as well as the bitemark evidence work of forensic odontology, in fact neither forensic pathology nor forensic odontology is forensic analysis. Rather they are, respectively, the specialized practice of medicine and dentistry. Nevertheless, the TFSC claims to have jurisdiction over forensic odontology but no jurisdiction over forensic pathology. Article 38.01 of the Texas Criminal Code states:

“Forensic analysis” means a medical, chemical, toxicological, ballistic, or other expert examination or test performed on physical evidence, including DNA evidence, for the purposes of determining the connection of the evidence to a criminal action, **except that the term does not include the portion of an autopsy conducted by a medical examiner or other forensic pathologist who is a licensed physician.**³⁷

The authors believe that, just as complaints against forensic pathologists can be directed to state medical boards and the National Association of Medical Examiners, complaints against forensic odontologists can be directed to state dental boards and the ABFO.

As a curious adverse effect, a forensic odontologist in Texas, as an “other entity” below, is now considered by the TFSC to be a “crime laboratory.” This designation instantly created at least 9 new crime laboratories in Texas now to be subject to TFSC oversight:

“Crime laboratory” includes a public or private laboratory **or other entity** that conducts a forensic analysis subject to this article.³⁷

The authors consider that of the 4 TFSC recommendations regarding bitemark evidence, the first 2 have already been addressed by both the current and proposed changes to ABFO Standards and Guidelines, and the fourth has been accomplished by the TFSC's Bite Mark Case Review Panel described above. The third, which deals with proficiency testing, is more complicated, but it is also under development.

The TFSC acknowledges that it does not have the authority to enforce its recommendations. In fact, testimony on bitemark evidence has been admitted in Texas criminal courts since those recommendations were published. The authors consider the TFSC's current practice of judging past bitemark cases based on current standards and guidelines to be illogical and unreasonable. Some of these are 20- to 30-year-old cases completed based on 30-year-old standards. If the dentists in those past cases did not follow the then-existing standards, that is another matter altogether and those dentists must accept responsibility. Odontologists have embraced valid criticisms from inside and outside the discipline and have made, are making, and will continue to make improvements.

PERSPECTIVES

An Attorney's Perspective

Forensic odontologists are not alone in questioning the motives and actions of the IP. Jeff Blackburn, Esq, an attorney from Amarillo, Texas was formerly chief counsel of the IP in Texas. He expressed his reasons for resigning that position in his May 13, 2015 resignation letter, which is excerpted below (personal communication with letter's author):

“When we founded this project 10 years ago we were part of a movement. That movement was a loose coalition of groups devoted to freeing the innocent and changing the criminal justice system from state to state. While we were doing that,

the New York-based Innocence Project went from being a small nonprofit to an organization with a multi-million-dollar budget. As its size grew, so did its appetite for money and its need to control the reform movement. What was once a movement has now become a business.”

“The Innocence Project now thrives on large contributions from the ultra-rich. It is full of Wall Street types and celebrities...I believe that staying connected with the New York people will compromise the work of criminal justice reform in this state.”

“I just don't feel like I can do that effectively if I am identified with the name ‘Innocence Project’ and the people in New York. They can keep their \$100,000 ‘VIP’ tables at galas, their friends from Goldman Sachs, and their need for control. It is not for me.”

A Judge's Perspective

Through efforts to block admission of bitemark evidence from Texas criminal courts, it appears that the critics are attempting to usurp the role of judges as expert evidence gatekeepers. Senior State District Judge Robert R. Barton of Kerrville, Texas in May 2016 commented on the perceived moratorium of bitemark evidence in Texas courts. His comments describe a sound basis for affirming that the courtroom is the proper place for arguments about admissibility.

Judge Barton wrote: “The judge may not use a recommended ‘moratorium’ to summarily and arbitrarily prohibit either party from attempting to use the evidence” and “if a judge finds within the adversarial framework either party's evidence is produced by the scientific method, the proponent will be permitted to present the evidence. Then, the opposing party can attempt to impeach the credibility of the proponent's witness, contradict the testimony with testimony of witnesses who disagree, and also seek to convince the jury that the proponent's evidence is not believable.”³⁸

In addition, according to Judge Barton, a potential constitutional issue would likely arise if an attempt was made to prevent a defendant from presenting exculpatory bitemark evidence.

The authors consider that these issues are well established to be within the purview of the court, not of the TFSC. Judges and both prosecuting and defense attorneys must critically evaluate their roles and properly vet the forensic specialists that they proffer and qualify to provide expert opinions at trial. As part of the vetting process, it is critically important that only well-qualified experts be allowed to testify. There might be instances when there are significantly conflicting opinions in a bitemark case. When such disagreement occurs or if a member of the judicial system believes it is indicated to seek additional consultation, a reputable odontologist can help provide clarity on any possible points of disagreement.

A Forensic Scientist Perspective

John M. Collins is a former firearms evidence scientist and former Director of Forensic Science for the Michigan State Police. Jay Jarvis was a Georgia State Crime Laboratory scientist for more than 30 years working in multiple areas, including firearms, tool marks, footwear, tire tread, latent prints, and others. In 2009, John Collins and Jay Jarvis wrote³⁹:

“The internal mechanisms of self-assessment combined with the external mechanisms of peer assessment must be allowed to find and correct weaknesses without the risk of reprisal. If the basic principles of quality control and quality assurance in forensic science become contaminated by politics and the natural inclination of activists to punish what they perceive

as wrongdoing, society can expect the forensic science infrastructure in the United States to collapse under its own weight. When all types of evidence, scenarios, and potential failures in our criminal justice system are considered in the proper context, it is likely that forensic science is, and has been, a leading preventer of wrongful convictions.”

“...As forensic science practitioners expand their collaborations with reputable academic institutions, the authors argue that there will be a decreasing tolerance for public policy recommendations that are based on ideological propaganda.”

“To the extent that public policy tactics of the Innocence Project and its affiliates in the innocence network are haphazard and inconsistent, difficult questions should be asked about the capacity of post-conviction litigators to honestly and properly interpret the significance of forensic science test results. Furthermore, intense desires to seek exonerations should be construed as a contextual bias that requires due caution to be exercised.”

A Forensic Pathology Perspective

William R. Oliver, MD, forensic pathologist and medical examiner in Knoxville, Tennessee, wrote: “Forensic pathology is a specialty where knowledge comes from experience, and it is a perceptual discipline where visual cognition is as, or more, important than the abstract weighing of evidence or evaluation of probabilities.”⁴⁰ He also recently published his third paper in a series on patterned injuries on skin in which he states, “These studies demonstrate the importance of history in the diagnosis of patterned injury of the skin. Denying history produces significant lack of consensus, primarily due to issues of ambiguity rather than actual differing diagnoses.”⁴¹

These same principles apply to forensic odontology. Forensic odontologists should be committed to using their experience in developing evidence-based opinions incorporating the best current practices.

A Forensic Odontology Perspective

Bitemark evidence can sometimes be found on objects, but cases involving bites on human skin are more common in legal proceedings. Bitemark recipients may include persons who are either victims or perpetrators of crimes. Biting by both is not rare in violent interactions. Bite recipients may be either living or deceased. Bitemark evidence on the living and the deceased involves more than diagnosis (analysis) and comparison. A human bitemark can:

- Signal violence and aggression
- Indicate the infliction of pain
- Indicate a site for potential collection of biological evidence (eg, DNA, salivary amylase)
- Cause permanent injury (eg, loss of tissue from body part)
- Signify abuse when found on any person from infant to elder
- Be offensive, defensive, or consensual in nature
- Be voluntarily or involuntarily self-inflicted
- Be anatomically located such that it could not have been self-inflicted
- Indicate the position of the biter's head in relation to the recipient's body part
- Provide a potential physical and/or temporal link between the recipient and the perpetrator
- Provide information about the age category of the biter (eg, child vs adult)
- Allow the odontologist to establish a dental profile of the biter
- Confirm, challenge, or refute an alleged biter's version of the incident

- Confirm, challenge, or refute a bite recipient's version of the incident
- Exclude a questioned dentition as having made the bitemark (this opinion should only be given when based on high-quality evidence and adherence to current standards and guidelines)
- Not exclude a questioned dentition as a dentition that could have made the bitemark (this opinion should only be given when based on high-quality evidence and adherence to current standards and guidelines).

Bitemark evidence at trial can be powerful and compelling. The tissue damage created by human teeth is demonstrable. The judges and juries that hear the testimony and see the demonstrations can better understand bitemark evidence, including the violent nature and potential pain associated with biting. It is understandable that critics who are advocates for persons accused of crimes with associated bitemarks or organizations that support those advocates may want to denounce bitemark evidence and prevent its admission in court. However, this may be ill considered for those whose clients are innocent since bitemark evidence can exclude and thereby help to protect those who may be wrongfully accused.

FORENSIC ODONTOLOGY — A PATH FORWARD

Like other forensic professionals, forensic odontologists critically examine and evaluate previous problem cases and those experts that have for whatever reason deviated from accepted standards. The following recommendations promote ongoing positive evolution in the management of bitemark evidence:

Standards and Guidelines

Previous problem cases occurred when odontologists could conclude that a particular person was identified as the biter with “reasonable medical, dental, or scientific certainty” or as “the biter” to what may have been viewed as the practical exclusion of all others. These levels of conclusion (ie, positive identification) are no longer condoned or endorsed in current ABFO Standards and Guidelines.⁴² Presently available is a decision tree that is designed to help the odontologist reach a valid defensible opinion regarding the evidentiary value of a purported bitemark. Once it has been determined that a patterned injury has been caused by human teeth, today an opinion in a bitemark report is limited to “inconclusive,” “dentition can be excluded as having made the bitemark,” or “dentition cannot be excluded as having made the bitemark.” Current ABFO Standards and Guidelines do not condone terminology that indicates the dentition of an individual is the only possible cause of the bitemark.

Many professional organizations have standing committees that address concerns raised about potential misapplication of published standards (including standards and/or parameters of care) and/or guidelines within a discipline. The ABFO has an active Ethics Committee that is populated by duly elected and appointed diplomates of the ABFO. Both the American Academy of Forensic Sciences and the ABFO have investigated and disciplined odontologists who have failed to follow published standards and guidelines or who have promulgated an opinion or opinions not based on sound principles or methods.

The ABFO, working in tandem with partners such as the Organization of Scientific Area Committees administered by the National Institute of Standards and Technology, is committed to developing and maintaining standards, guidelines, and best practices that promote appropriate methodologies and censure unsupported opinions.

Knowledge Transfer and Education

Forensic dentistry programs that include a bitemark study component exist in at least four North American universities. They are linked with coroners or medical examiner agencies and, thus, promote interaction with other forensic disciplines and specialists in practical, mock, and/or experimental casework. Opportunities for improving knowledge and skills should be provided by experienced educators that specialize in the subject matter and attempt to foster knowledge transfer to existing and potential colleagues. It is recommended that educators (a) collaborate with less experienced dentists on casework, (b) mentor others through historical and current case reviews, (c) discuss and promote implementation of standardized analytical and interpretation protocols, (d) cooperate with those seeking knowledge in ways that are meaningful and significant, and (e) inform interested parties about the latest research outcomes and conclusions.

Research

It is important for odontologists to continue to investigate issues of the distinctiveness of portions of teeth involved in biting. Studies of the properties of human skin in both living and deceased persons in relation to the skin's reaction to bites must also continue. The study of bitemark evidence protocols, methods for bitemark analyses, and methods for bitemark comparisons on humans and surrogates is needed and must be done only with institutional review board, ethical review board, and human subjects review panel approval.

Certification

Currently, among other requirements to become eligible to challenge the ABFO certification examination, odontologists must have completed and successfully reviewed a minimum number of bitemark cases, which they are encouraged to complete under the mentorship of an ABFO certified odontologist. This is most often accomplished in a university-based program and/or in coroner or medical examiner facilities. As part of the board eligibility process, a committee of board certified odontologists evaluates applicants' cases. Once an applicant becomes eligible to challenge the certifying examination, each must meet or surpass minimum competency standards set by the ABFO. The authors support and endorse the following statement⁴:

“...No person (public or private) should be allowed to practice in a forensic science discipline or testify as a forensic science professional without certification. Certification requirements should include, at a minimum, written examinations, supervised practice, proficiency testing, continuing education, recertification procedures, adherence to a code of ethics, and effective disciplinary procedures.”

Proficiency

It is the opinion of the authors that all odontologists certified by the ABFO should periodically take and pass ABFO proficiency tests for all areas of forensic odontology practice.

Casework

Assessment of the quality, quantity, and significance of the materials involved is the first step in all casework. All odontologists should critically evaluate the evidentiary value of the key information and materials, never proceed with low-quality evidence, and seek independent verification in the form of at least 1 qualified second opinion before giving a final opinion that excludes or does not exclude individuals in bitemark cases.

SUMMARY

Steps continue to be taken by organized forensic odontology to inform and educate all odontologists about current important developments, including the underlying causes of wrongful convictions. Moreover, further efforts are well underway to standardize approaches to casework that use internal and external validation methods along with the care and the quality assurance procedures that promote sound conservative conclusions within accepted benchmarks. In summary, the authors agree with the comments below adapted from the final paragraph of an article published by a critic of bitemark evidence.⁴³

- Respect the bounds of actual knowledge
- Abandon claims of uniqueness and absoluteness
- Abandon the use of misleading terminology, that is, match, identification, or scientific certainty
- Offer descriptions and opinions with clarity and candor
- Offer conclusions with modesty, unless and until a body of serious empirically based knowledge allows more
- Resist the culture of exaggeration
- Whenever possible, utilize evidence-based forensic science.

An adequate adversarial system is already in place regarding the admission of relevant evidence and the qualifying of expert witnesses. Odontologists today are more reflective and conservative in their approach to bitemark casework. Judges should continue to improve their skills as gatekeepers. This gatekeeping role must not devolve to third parties that are potentially unqualified or may have partisan political or financial agendas.

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