BITE THIS! THE ROLE OF BITE MARK ANALYSES IN WRONGFUL CONVICTIONS

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Abstract

Forensic science encompasses a diverse range of areas. Some of the areas include fingerprint analysis, firearm and tool mark analysis, hair and fiber analysis, and bite mark analysis. Bite mark analysis is perhaps the most controversial of these areas because the analysis and interpretation of bite marks is almost completely subjective and there is a dearth of empirical research examining the technique. Despite this, courts have almost universally accepted bite mark evidence. Given the lack of existing literature on the subject, this paper aims to contribute to the criminal justice literature by detailing the process of bite mark analysis, explain the potential for inaccuracy in bite mark analysis, and present case studies of wrongful convictions involving bite mark analysis.

**Key words:** bite mark analysis, forensic science, court system, wrongful conviction

INTRODUCTION

The use of forensic evidence to secure convictions has come under increasing scrutiny in recent years due to the wrongful conviction of a number of defendants based on incorrectly
interpreted forensic evidence (Fisher, 2008). Forensic science encompasses a diverse range of areas, including fingerprint analysis, firearm and toolmark analysis, hair and fiber analysis, and bite mark analysis, to name a few. Of these areas, bite mark evidence is perhaps the most contentious, because courts have universally accepted bite mark evidence, yet the process of bite mark analysis is almost completely subjective and there is a paucity of empirical research examining the technique (Heras, Valenzuela, Valverde, Torres, and Luna-del-Castillo, 2007). Despite a number of high profile wrongful convictions that have involved faulty bite mark analysis, there is a dearth of academic literature on the subject. Bowers (2006) notes, “the dental literature concerning bite mark methodology is surprisingly thin and sorely lacking in rigorous scientific testing” (pg. 104); however, legal case law in this area is quite strong (Bowers, 2006). Given the lack of existing literature on the subject, the goal of the present paper is to contribute to the criminal justice literature by detailing the process of bite mark analysis, explain the potential for inaccuracy in bite mark analysis, and present case studies of wrongful convictions involving bite mark analysis.

FORENSIC ODONTOLOGY

Forensic odontology, a sub-discipline of dentistry, has been described as the area where dentistry and the law intersect (Bernstein, 1997), though this description fails to describe the full range of legal applications of the discipline. Forensic odontology encompasses such diverse procedures as the identification of human remains using dental records, testifying as an expert witness in a criminal trial where a bite mark is involved, testifying as an expert witness in a civil trial where dental malpractice is alleged, estimating the age of an alleged illegal immigrant for an immigration agency, or perhaps consulting in administrative actions where a dentist must appear before a State Board of Dentistry.

Though there is a certifying body for forensic odontology (the American Board of Forensic Odontology [ABFO]), it is not currently recognized as a specialty area by the American Dental Association (American Dental Association, 2008). In light of this, most jurisdictions do not permit a forensic dentist to announce to the public that s/he is a “specialist in forensic odontology” (Texas State Board Dental Examiners Rules and Regulations, 2008). Instead, the permitted form is a “general dentist who limits her practice to forensic odontology” (Texas State Board Dental Examiners Rules and Regulations, 2008).\(^1\)

Bite Mark Basics

Bite mark analysis, as well as the identification of human remains by dental records, was

\(^1\) Most states allow dentists to announce specialty status in only the nine ADA-approved specialties including, oral & maxillofacial surgery, oral & maxillofacial pathology, oral & maxillofacial radiology, endodontics (root canals), prosthodontics (crown & bridge and dentures), periodontics (gum surgery), orthodontics (straightening), pedodontics (children’s dentistry), and dental public health. In particular, other dental “specialties” that are often claimed, but are not officially recognized, are: “cosmetic dentistry,” “implant dentistry” (see Potts v Zettel, 2007), and “family dentistry.” There are certification boards for these areas, but, nonetheless, the subdisciplines are not recognized by the ADA because they do not meet the formal minimum educational requirements established by the ADA.
historically predicated on the theory that every person’s dentition is unique (Bowers, 2006; Heras, 2007). This is an assumption yet to be proven, though several odontologists claim to have proven this proposition mathematically (Bowers, 2006). However, one might conclude it is impossible to state that everyone’s teeth are unique simply because everyone’s teeth have not been examined.

It is herein argued that the ultimate question upon which the foundation of bite mark analysis should be built is not, Is every person’s dentition unique? but, rather, Can two people have teeth which are similar enough to be indistinguishable in a bite mark analysis? Much time and intellectual effort has been spent by odontologists attempting to prove uniqueness, but the uniqueness of every person’s teeth is not the only factor to be considered. Notably, human skin, the most common material on which a bite mark is inflicted, is a notoriously poor impression material. In a real bite mark situation, the victim is not passively sitting by and letting the perpetrator make the bite mark—the conscious victim is twisting and squirming and trying to get away, and distortion is introduced. Given the circumstances under which an assailant might bite another person, a bite does not cause a perfect reproduction of the perpetrator’s teeth in the bite mark on human skin. Since, the bite mark is not a perfect reproduction, it is conceivable that another set of teeth might “fit” the bite mark, even though those other teeth did not cause the mark. Empirical research in this area is scarce, but Bowers (2006) describes an ABFO workshop where ABFO diplomats attempted to match four bite marks to seven dental molds and false positives were achieved in 63.5% of the cases. An empirical study of digitized three dimensional bite marks from Blackwell, Taylor, Gordon, Ogleby, Tanijiri, Yoshino, Donald, and Clement (2007) found that 15% of combinations of dentitions and bite marks in their study were incorrectly identified as matching. While difficult to generalize to real world settings, this error rate translates into 6 people out of 42 at risk of being wrongfully convicted, absent any other compelling evidence. These findings echo similar research from Pretty and Sweet (2001) in their study on bite marks in pigskin, which found error rates to range from 11.9% to 22%.

While more research in this area is needed, the aforementioned studies do suggest that the “science” of bite mark analysis is far from exact. This is partly attributable to the fact that bite mark analysis does not always follow a well-defined procedure. In the section that follows, the process of bite mark analysis will be outlined in detail to provide a “best case scenario” of how a bite mark might be scientifically examined. In very general terms, the analysis involves the following: (a) examination and documentation of the patterned injury on the victim, (b) examination of the suspects teeth, which includes obtaining appropriate photographs, impressions, and dental stone models of the teeth, and (c) comparison of the two to determine whether, in the examiner’s opinion, the suspect may have inflicted the bite.

While the examination and documentation of the victim’s injury most often involves the examination of a deceased victim in the morgue, it is possible for bite mark cases to involve a

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2 This is one reason bitemarks are often valuable to the prosecution in a criminal case—in a criminal homicide case, a bitemark could link the biter to the victim, place the biter at the scene of the crime at around the time the homicide was committed, indicate intent rather than accident, and be used as an enhancement or aggravating circumstance.
living victim, wherein the victim bites the suspect. In cases involving a deceased victim, the forensic odontologist is usually contacted by the medical examiner’s office, and requested to examine a patterned injury on the decedent that might be a bite mark. Once the records are collected and assembled, the process of bite mark analysis begins by determining if the injury indeed can be considered a bite mark. To answer this question, often the injury will be photographically documented and an appropriate measuring scale or ruler will be placed in the image so that the injury may be accurately measured. The ABFO even has their own special L-shaped ruler, the “ABFO No.2” which was developed by odontologists, and is the appropriate size and has features designed to help limit photographic distortion in the resulting image.

An impression might be made of the potential bite mark with the same impression materials used in routine dental practice. For example, in the Tarrant County Medical Examiner’s District office in Fort Worth, Texas, where the first author is employed, the standard operating procedure in bite mark cases calls for impressions of the injured area to be made with vinyl-polysiloxane dental impression material. Anecdotal evidence reveals that impressions of the wounded area do not often pick up three-dimensional detail of the injury, but when they do record this detail, it is usually very helpful in the analysis.³

Upon securing a search warrant to conduct the examination⁴, the suspect’s teeth are examined using the same instruments and techniques used in everyday dental practice. Special notation is made of the condition of the suspect’s teeth and gums, as well as any existing restorations. Impressions of the suspect’s teeth are made using routine dental procedures and materials, and dental stone models are then made of the suspect’s teeth. Finally, the odontologist will take a number of photographs of the suspect’s teeth. In an effort to reduce bias, it is often considered good practice that the odontologist performing the bite mark analysis not to be the dentist who examines the suspect.

Once the records are collected and assembled, the process of bite mark analysis begins by determining if the injury indeed can be considered a bite mark.⁵ Odontologists determine whether the injury is a bite mark by considering the class characteristics and individual characteristics of teeth that may be present in the injury. In very general terms, bite marks often may present as an oval injury that consists of two semi-ovals or “U-shaped” arches, one caused by the upper six and one caused by the lower six front teeth. There are reports of so-called “single-arch” bites, i.e. a bite mark that was caused by only the upper or by only the lower teeth. These may be difficult for the odontologist to explain.⁶ The odontologist must also consider the

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³ This short synopsis assumes that if DNA evidence was potentially available from the injury, it would already have been collected by either the morgue staff or the odontologist

⁴ Many odontologists seem to prefer that a proper search warrant be obtained prior to examining the suspect, even if the suspect consents voluntarily to the examination. Occasionally, a suspect will be uncooperative and there are several anecdotal reports of suspects being sedated by the appropriate medical professionals so that the dental examination can be performed.

⁵ Under current ABFO guidelines, there are three suggested conclusions in the analysis as to whether an injury is a bitemark or not: (1) the injury is a bitemark, (2) the injury is suggestive of a bitemark, or, (3) results are inconclusive.

⁶ Anecdotally, among other theories, some odontologists feel that clothing or some other object such as a quilt or blanket may cover part of the victim’s skin where the perpetrator is biting and thus prevent one of the suspect’s dental arches from “registering” in the mark.
location of the mark to determine if it is feasible the victim inflicted the bite mark herself. Once the odontologist is satisfied the injury is a bite mark, then comparison with the suspect’s dental records can proceed. The essential idea is that an image of the incisal edges (the “biting edges”) of the suspect’s teeth is superimposed on an image of the bite mark, and then it can be seen whether the images “match” or “fit.”

For comparison purposes, there are a number of variations on “paint-the-edges” methods proposed where the edges of the suspect’s teeth on the plaster model are highlighted with a bright color paint, photographs made of the painted teeth, outlines of these teeth traced onto clear acetate sheets, and the clear sheets with the outlines placed on photographs of the bite mark to determine whether or not there is a “match.” Anyone who has done some photography will probably quickly realize it is critically important in such a method to ensure that the enlargement ratio of the photographs is identical in order to make a fair size comparison. In the worst-case scenario, an unscrupulous operator could conceivably modify the size of a photograph of the suspect’s teeth in order to make them fit a bite mark. Odontologists thus insist that a ruler be properly located in the photographs used for comparison.

Another popular method for preparing transparencies of the suspect’s teeth for comparison involves the use of a photocopier. The plaster model is simply placed on the glass platen of the photocopier and a one-to-one photocopy of the plaster model is made. The ABFO No. 2 scale should be appropriately positioned in the image and there should be an additional image of the ABFO No. 2 scale present for comparison with the actual ABFO No. 2 scale to determine if the image is indeed one-to-one. Then, when an acetate sheet is placed on the photocopy, and the outlines of the edges of the front teeth traced, the resulting tracing is, ostensibly, one-to-one. This tracing is, as before, placed on the image of the bite mark to determine if, in the odontologist’s opinion, there is a “fit.”

In this process, the tracing of the edges of the suspect’s teeth is supposed to be one-to-one, making it necessary for the photograph of the bite mark to also be one-to-one, ensuring a fair comparison. Previously, very few forensic odontologists did their own darkroom work in making photographic prints. Instead, odontologists had to rely on the photo lab to make a correctly sized one-to-one photographic print of the bite mark, and different labs may have had varying standards as to the accuracy of the one-to-one prints. In addition, and perhaps more problematic, there was much subjectivity introduced in this method when tracing the edges of the suspect’s teeth by hand. These problems are often not found in more current bite mark cases as odontologists have moved into the digital age and now use an electronic photo enhancement program. Images of the models of the suspect’s teeth can easily be “imported,” superimposed, and compared in an electronic photo enhancement program. Additionally,

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7 In forensics, “match” and “fit” are loaded terms that probably should be avoided, if possible. They may convey to a jury a finding much stronger than the expert intended.
8 It is also necessary to “flip” the clear acetate sheet over horizontally when it is placed on the photograph of the bitemark in order to properly orient the image for the comparison. The careful odontologist will clearly mark the transparencies so that he can tell whether they have been “flipped” over or not. It is very embarrassing in court if opposing counsel “accidentally” drops all the odontologist’s carefully arranged transparencies, and the odontologist is not sure if they are put them back in the proper orientation or not.
certain areas of an image can be emphasized by varying the brightness, contrast, hues, and of an image. This process also aids in the ease of adjustment to the enlargement ratio of the images being compared in order to ensure a fair size comparison. A well-respected ABFO member, Dr. Michael Bowers, has written a manual detailing standard procedures for analysis of digital bite mark evidence for forensic odontologists (Raymond and Bowers, 2003).

Once the comparison has been made, the ABFO suggests the following conclusions might be reached about whether or not the suspect’s teeth “fit” the bite mark:

1. Reasonable Dental/Medical/Scientific Certainty – beyond a reasonable doubt.\(^9\)\(^10\)

2. Probable – more likely than not.


4. Inconclusive – insufficient evidence to relate the bite mark to the suspected biter (ABFO, 2008).

As the preceding section demonstrates, the process of bite mark analysis is fraught with difficulty and there are many points in the analysis where bias and error can be introduced. Nevertheless, bite marks have routinely been admitted as evidence in court cases. To explain why this is the case, it is necessary to examine the relevant case law in this area. Evidence admissibility under the Frye and Daubert standards

Before an examination of the admissibility of bite mark evidence can commence, it is necessary to examine the admissibility of scientific evidence more generally. For this we turn to the Frye case. James Alphonzo Frye was arrested in 1921 for murder; a crime to which he confessed (Frye v. United States, 1923). James Marston, creator of the systolic-blood-pressure deception test (a crude precursor to the modern polygraph instrument), examined Frye and became convinced of Frye’s innocence. However, this evidence was not allowed into evidence at trial, a decision upheld on appeal on the basis that the new deception test had not gained “general acceptance in the field.”

The “general acceptance in the field” (i.e. Frye) standard was the prevalent standard in United States courts for about 50 years until the Federal Rules of Evidence (FRE) were promulgated and eventually became effective in 1975. Rule 702 of the FRE says:

“If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert

\(^9\) This standard holds the potential for confusion because many attorneys are accustomed to dealing with “reasonable medical probability” in tort cases which is defined by the Second Pocket Edition of Black’s Law Dictionary as “… a standard requiring a showing that the injury was more likely than not caused by a particular stimulus …” i.e. by a preponderance of the evidence.

\(^10\) Odontologists have to remember to be careful with this two-pronged process—it is not very logical to determine the injury is “suggestive” of a bitemark and also that the suspect made the mark with “reasonable medical/dental certainty.” There have been a identification of a perpetrator, or without doubt, are not sanctioned as a final conclusion.”
by number of iterations of this suggested list over time, and the ABFO manual goes on to say “[t]erms assuring unconditionalknowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.”

Thus a potential conflict became apparent—was it enough that evidence was generally accepted in the relevant field, or must evidence now meet the 702 requirements as well, or did 702 completely supersede the Frye test?

The answer did not arrive until 1993 when the U.S. Supreme Court decided *Daubert v. Merrell Dow Pharmaceuticals* (William Daubert, et ux, etc., et al v. Merrell Dow Pharmaceuticals, Inc., 1995). Along with the *Daubert* progeny, *Kumho Tire* (Kumho Tire Co., Ltd., et al v. Patrick Carmichael, etc., et al, 1999) and *Joiner* (General Electric Co., et al v. Robert K. Joiner, et ux, 1997), the Court indicated the federal trial judge must act as the “gatekeeper” in deciding what scientific evidence to allow in, and the Court enumerated a number of non-exclusive factors the trial judge might consider in deciding whether some offered evidence meets the *Daubert* standard or not. Specifically, the Court said the trial judge could consider: (a) whether the technique could be, or has been, tested, (b) whether the theory has been subjected to peer-review and publication, (c) [should ordinarily consider] the known or potential rate of error, and the existence or maintenance of standards controlling the technique’s operation, and (d) general acceptance in the field. The factors were further elaborated in *Kumho Tire*.

The Court explicitly held in *Daubert* that FRE 702 did supersede *Frye*, at least in federal courts. According to on-line internet services that track such matters, there are a number of states which still follow the *Frye* standard, there are a number which have adopted *Daubert*, and there are some which use a blend of *Frye* and *Daubert* (Daubert on the Web, 2008; Daubert Tracker, 2008). For example, Texas is generally considered to be a “*Daubert* state.” The Texas Court of Criminal Appeals, Texas’ highest court for criminal matters, in 1992 explicitly rejected *Frye* in *Kelly v. State*, even before the U.S Supreme Court decision in *Daubert*, and adopted a set of factors that were later mirrored in *Daubert*.11 Under *Kelly*, the trial judge must first determine whether scientific evidence is reliable and relevant, and will help the jury reach an accurate verdict, and then determine if the evidence is, nonetheless, inadmissible on other grounds.12 The Texas Supreme Court, Texas’ highest court for civil and juvenile matters, in *E.I.*

11 The non-exclusive “Kelly factors” are: (1) the extent to which the underlying theory and technique are accepted as valid by the relevant scientific community, (2) the qualifications of the testifying expert(s), (3) the existence of literature supporting or rejecting the underlying scientific theory and technique, (4) the potential error rate, (5) the availability of other experts to test and evaluate the technique, (6) the clarity with which the underlying scientific theory and technique can be explained to the court, and, (7) the experience and skill of the person(s) who applied the technique in this case.

12 The “Kelly factors” for reliability were listed as: (1) the underlying scientific theory must be valid, (2) the technique applying the theory must be valid, and, (3) the technique must have been properly applied on the occasion in question.
The first known bite mark case is the 1954 Texas case *Doyle v. State*. Doyle’s conviction was initially based on bite mark evidence. The importance of this case in the US was that the bite mark taken for examination was from human flesh; moreover, as the injury had been sustained to the nose it was deemed possible to recreate a three-dimensional image of a suspect's dentition (Souviron, 2006). This evidence was examined by a firearms and tool mark examiner, not a dentist, nor someone trained in forensic odontology. The evidence was later sent to a well-respected and very experienced dentist, Dr. William Kemp, for further examination. Dr. Kemp was not a forensic odontologist, and he never made such a claim. The discipline of forensic odontology was not clearly established in 1954 and the well-defined organizational structure that exists in the present simply had not been created. Further, there was no body of published literature in this area at that time and there were no formal or informal forensic odontology training programs available. Perhaps most problematic, was that in Doyle, there was absolutely no examination of the underpinnings of the procedures used by the experts. Nonetheless, the testimony of these two experts on this novel procedure was admitted, and the verdict upheld by the highest court in the state. Had the Frye standard been applied, this evidence surely would not have been admitted.

Since the *Frye* standard was not applied in Texas, because at the time Texas followed the common law rules of evidence and expert testimony, the *Doyle* case made it relatively easy to have expert testimony about bite marks admitted in subsequent cases. In fact, the next reported bite mark case was another Texas case in 1974, *Patterson v. State*. In *Patterson*, the appellate court rejected defense counsel’s dispute about the reliability of bite mark analysis by simply noting that similar evidence had previously been admitted in *Doyle*.

As explained by the Court of Appeals for the District of Columbia in *Frye*, the common law standard for admitting expert testimony prior to the Frye case was that the subject matter had to be beyond the normal scope of common knowledge and such that a person without without such specialized knowledge or expertise. Under these circumstances, expert testimony would be admissible as evidence. This was likely the rule that the Texas Court of Criminal Appeals followed in *Doyle* and interestingly enough, this old rule is not entirely dissimilar from *Daubert*.

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*du Pont de Nemours & Co. v. Robinson* then adopted in 1995, just after the *Daubert* decision, a set of non-exclusive factors very similar to the *Daubert* factors.\(^{13}\)

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\(^{13}\) The non-exclusive “Robinson factors” the Court listed are: (1) the extent to which the theory has been or can be tested, (2) the extent to which the technique relies on a subjective interpretation by the expert, (3) whether the theory or technique has been subjected to peer review or publication, (4) the technique’s potential error rate, (5) the general acceptance of the theory or technique in the relevant scientific community, and, (6) the nonjudicial uses to which the theory or technique has been put.
People of California v. Marx

The 1975 case, *People of California v. Marx*, is considered by some to be “the leading bite mark case” (Giannelli, 2008). Indeed, according to Souviron, (2006) it "has been used as the standard for admissibility of bite marks." In Marx, the court held that bite mark evidence was acceptable provided that the experts used tested methods and provable hypotheses (Bowers, 2004). Marx was charged with the murder of his landlady, and found guilty of voluntary manslaughter in a bench trial. In this trial there were three dental expert witnesses for the prosecution and one for the defense.14

The victim was murdered in California, then embalmed and transported to and buried in Dallas. Marx was identified as a suspect and was subsequently arrested. While in jail he was asked to provide fingerprints and samples of his hair, a request that he refused. A search warrant was then secured to obtain fingerprints, hair, and impressions of Marx’ teeth.

Forensic dentists did not perform an examination on the victim while her body was still in California. Instead, almost seven weeks after her burial in Dallas, she was exhumed and Dr. Irving Stone, a non-dentist, of the “Forensic Science Institute in Dallas County” (sic) (Vale, 2005), examined and made impressions of the bite mark inflicted on the victim’s nose.15

Regarding the admissibility of the bite mark evidence, the defense took particular issue with the lack of standardized scientific procedural guidelines to identify someone based solely on their bite mark. The defense noted that the three prosecution experts seemed enthusiastic at the rare opportunity to able to develop and extend forensic dentistry into the identification of bite marks. Despite these concerns, the appellate court upheld the conviction and noted that while bite mark identification might indeed be novel, the methods used to make the identification (e.g. x-rays, photography, etc.) were well established and therefore admissible.

People of Illinois v. Milone

*Milone* is considered by some to be one of the most controversial cases involving bite mark evidence due to constitutional issues, great conflict over the dental findings themselves and because the case took nearly 23 years to be resolved (Vale, 2005:13). Richard Milone was convicted in 1972 of the murder of 14-year-old Sally Kandel. On appeal he claimed, *inter alia*, that taking impressions of his teeth violated his U.S. Constitutional rights because he alleged there was no probable cause for the search warrant to be issued. He further contended that taking the dental impressions violated his right to privacy and his privilege against self-incrimination. The Appellate Court of Illinois cited the 1909 *Holt v. United States* case where the U.S. Supreme Court held “the prohibition of compelling a man in criminal court to be a

14 For the prosecution: Drs. Reidar Sognnaes, Gerald Vale, and Gerald Felando; for the defense Dr. Nedelman. The prosecution experts’ opinions were similar and generally were that the defendant made the bitemark—though Felando opined “...[w]ithout a doubt...the suspect’s teeth did make the bite mark.” Was this the genesis of the later much oft used-and-abused unfortunate phrase “...indeed and without a doubt...” used to describe the expert’s degree of certainty that a suspect had inflicted a bitemark?

15 Anecdotally, this particular bitemark remains, to this day, one of the “best” bitemarks forensic odontologists have ever seen in an actual case (Vale, 2005).
witness against himself is a prohibition of the use of physical or moral compulsion to extort communication from him, not an exclusion of his body as evidence when it may be material.”

The Illinois court further cited the now familiar *Doyle* and *Patterson* Texas cases.

On the issue of unreliability of bite mark evidence, the court stated, “[t]he concept of identifying a suspect by matching his dentition to a bite mark found at the scene of a crime is a logical extension of the accepted principle that each person's dentition is unique” (emphasis added). In this particular case, the three expert witnesses for the prosecution had presented over 1300 pages of dental testimony and exhibits and each had reached the conclusion Milone had, without a doubt, inflicted the bite on the victim. The defense was able to produce four expert witnesses who concluded that the bite mark on the victim did not match Milone’s dentition.

Despite the disagreement between the expert witnesses for the prosecution and defense, Milone was convicted of murder and sentenced to 90 to 175 years in prison. Ten years after his conviction, he petitioned for a writ of habeas corpus in federal court in 1986 and also made a request for executive clemency. The Governor directed the State Police to submit the bite mark evidence to three additional unbiased experts in forensic odontology in light of the conflicting expert opinions offered at trial. The Governor later denied Milone’s request for clemency on the basis that the additional odontologists were all of the opinion that Milone inflicted the bite mark on Sally Kandel. The federal district court then denied Milone’s habeas corpus petition. Milone appealed this denial to the U.S. Court of Appeals for the Seventh Circuit and asserted claims that bite mark analysis was unreliable at the time of his first trial and therefore should have been excluded as evidence. His claim further stated that bite mark evidence had become reliable by the time his case was appealed and there was substantial evidence that the bite mark matched the dentition of Richard Macek, a known serial killer. The Seventh Circuit affirmed the district court’s denial of Milone’s petition, and the U.S. Supreme Court denied a writ of certiorari.

*Wilhoit v. State of Oklahoma*

Gregory Wilhoit was convicted of the 1987 first-degree murder of his wife, and sentenced to death. On appeal to the Court of Criminal Appeals of Oklahoma, Wilhoit moved for a new trial based on the points of error of newly-discovered evidence and ineffective assistance of counsel. The State’s forensic odontologists were Drs. Richard T. Glass and Keith R. Montgomery. Glass had testified that there was an unusual type of bacteria found in the bite mark injury on Wilhoit’s wife, and that the same type of bacteria was cultured from Greg Wilhoit’s mouth. Based on this information, he then identified Wilhoit as the biter. Montgomery also identified Wilhoit as the biter. Wilhoit’s family had contacted and retained the well-respected Dr. Tom Krauss as defense expert witness. Inexplicably, Wilhoit’s trial attorney did not make the dental evidence available to Krauss, and counsel did not call Krauss as a witness to rebut the testimony of the State’s experts. Dr. Krauss worked with a public defender later on Wilhoit’s appeal, and Krauss eventually brought in 10 other ABFO-certified forensic odontologists to rebut the opinions of Glass and Montgomery. Furthermore, a professor
of microbiology was called and testified the “unusual” bacteria Glass found was actually extremely common in humans’ mouths.

Ultimately, Wilhoit’s motion for new trial was denied on the issue of newly discovered evidence because the Court found defense counsel had simply not been diligent in locating existing evidence. However, a motion for new trial was granted on the issue of ineffective assistance of counsel, because the Court held counsel was suffering from alcoholism and brain damage during the trial, and his deficient performance denied Wilhoit a fair trial. On remand, the trial court heard the prosecution’s case in chief and then directed a verdict of “not guilty.”

AND THEN THERE WAS DNA

The above mentioned cases were from an era prior to widespread, routine use of DNA testing. In the early 1990’s, DNA testing became available on a limited basis for forensic cases. Prior to the 1990’s, bite marks had been swabbed and tested for the presence of the salivary enzyme α-amylase. However, the advent of DNA analysis allowed for the possibility that the biter’s unique DNA could be recovered from the bite mark and matched to the suspect. A number of recent “high-profile” bite mark cases have appeared in the news where a defendant was convicted on the basis of bite mark evidence, but then later DNA testing exonerated the defendant. Three such cases will be detailed below and each case helps to demonstrate the inherent unreliability of bite mark analysis.

Ray Krone and Dr. Ray Rawson

Ray Krone was convicted of first-degree murder and kidnapping of Kim Ancona, and sentenced to death (State of Arizona v. Ray Milton Krone, 1995). Ancona was discovered nude, stabbed, and dead in the men’s restroom of the bar where she worked as a bartender. There was little evidence to link Krone directly to the murder, as no fingerprints or semen were recovered from the scene. Saliva and hairs were recovered, but neither could be linked directly to Krone. There were no DNA tests, but there were bite marks on Ancona’s neck and left breast. Krone was a suspect because he knew Ancona and witnesses testified Krone was supposed to help her close the bar the night of the murder. He was questioned and he gave an impression of his teeth, which the state believed matched the bite marks on the victim.

The prosecution delivered a videotape to defense counsel on the Friday before the trial was to begin. The tape was made by Dr. Ray Rawson, forensic odontologist from Las Vegas, and was arguably a very important part of the state’s case. Krone moved to exclude the late-disclosed tape, or, in the alternative, for a continuance for his own expert to examine the tape and possibly produce a videotape of his own. Both motions were denied.

The Arizona Supreme Court reversed and remanded, holding Krone’s defense was prejudiced by admission of the videotape, the error could not be harmless, and that the trial had erred by not granting a continuance or barring admission of the tape. In the 1996 retrial, Rawson testified that Krone’s teeth were a “scientific match” to a blood-stain pattern on
Ancona’s halter-top, and Krone was once again convicted, even though defense counsel called well-respected expert Dr. Homer Campbell to rebut Rawson’s testimony. Later DNA analysis showed that Krone was definitely excluded as the biter, and that another inmate, Kenneth Phillips, in prison for a sexual offense, was very strongly implicated. The newly admitted DNA evidence ultimately led to Krone’s exoneration.

Due to the striking similarity of testimony offered by Rawson in the Krone trial and in the subsequent Tankersley trial (*State of Arizona v. Tankersley*, 1998), state prosecutors asked the Arizona Supreme Court to order new DNA tests on evidence from the Tankersley case (Chicago Tribune, 2004). Bobby Lee Tankersley had been convicted and sentenced to death for the murder of Thelma Youkin. The Court found the DNA results were insufficient to grant exoneration, but that Rawson’s testimony on the bite mark evidence was suspect, and ordered a new sentencing hearing. Tankersley’s sentence was reduced from death to life imprisonment with the possibility for parole. Rawson has since retired from forensic odontology (Chicago Tribune, 2004).

*Kennedy Brewer, Levon Brooks, and Dr. Michael West*

Kennedy Brewer was convicted in Mississippi of the capital murder of three-year-old Christine Jackson and sentenced to death (*Kennedy Brewer v. State of Mississippi*, 2002). Brewer was convicted largely on the strength of the testimony of odontologist Dr. Michael West. West testified Christine had bite marks “all over her body” and they were “caused by the two front teeth” of Brewer (U.S. News & World Report, 2008). In Dr. West’s report to the county medical examiner, he stated the bite marks were inflicted by Kennedy “indeed and without a doubt,” West’s seemingly favorite catch-phrase (Francescani and Baram, 2008).

In a similar case three years earlier, West testified that Levon Brooks’ teeth matched bite marks found on the body of three-year-old Courtney Smith. This lead to the conviction of Brooks of capital murder, and he was sentenced to death (Francescani and Baram, 2008). The two rapes and killings were about 18 months apart in time and about 20 miles apart in distance.

Later DNA analysis strongly linked another man, Justin Johnson, to the semen found in Christine, and he confessed to both of the killings (Francescani and Baram, 2008). Forensic experts who examined the bites said the wounds on Christine were not even human bite marks at all, they were insect and crawfish bites. Dr. David Senn of San Antonio, Texas, the incoming president of the ABFO, said “[we are] scratching [our] heads to figure out how he could come to the conclusions he came to” (Francescani and Baram, 2008).

West is one of the few ABFO Diplomats to have resigned his certification, and he has also resigned from the AAFS, the American Society of Forensic Odontology (ASFO), and the International Association for Identification (IAI); however, he has testified in the past that his error rate in bite mark analysis is “something less than that of my savior, Jesus Christ” (Balko, 2007), and he astonishingly maintains that in the Kennedy and Brooks cases, he is still correct—he claims he never said that Kennedy or Brooks committed the respective rapes, just that they inflicted the bite marks:
“I never testified that Mr. Brewer raped or sodomized anyone, I testified that Mr. Brewer bit [Christine Jackson]’ West said in 2002.

“So [Brewer] bit her, and two other people raped and sodomized her?” he was asked.

“That’s a possibility,” West replied (Francescani and Baram, 2008).

In an unprecedented action, the Innocence Project has called for the criminal prosecution of West, alleging he fabricated evidence in these two cases. This is significant and marks the first time the Innocence Project in Mississippi has called for the criminal prosecution of a scientist (Francescani and Baram, 2008). The Innocence Project was reported to have been pressing prosecutors to seek attempted murder charges against West for knowingly fabricating evidence in a capital murder trial (Francescani and Baram, 2008).

“The state’s [Mississippi’s] Innocence Project is examining about 80 cases of potential forensic fraud, said director W. Tucker Carrington on Wednesday. Most of those involve testimony from either Dr. Steven Hayne, Mississippi’s primary forensic pathologist, or Dr. Michael West, a forensic dentist based in Hattiesburg, Carrington said. Carrington said his office is trying to ‘ID all cases in which Dr. West has testified.’ West’s work in bite-mark forensics has been largely discredited” (Butler, 2008).

Robert Lee Stinson and Dr. Tom Johnson

In 1984, Dr. L. Thomas Johnson of Marquette University concluded bite marks on victim Ione Cychosz “had to have been made by teeth identical” to those of Robert Lee Stinson, and “there was no margin of error in this” (American Society of Forensic Odontology, 2008; State of Wisconsin v. Robert Lee Stinson, 1986). This was the first known bite mark case in Wisconsin courts, and Stinson was convicted of first-degree murder. Testifying in the case for the prosecution was also Dr. Ray Rawson (defense had retained a dental expert as well, but he was not called to testify). Interestingly in this case, the defendant had a twin brother, Robert Earl Stinson. Robert’s teeth were examined as well, but Johnson determined there were “gross discrepancies” between the two, and Robert could be ruled out as the biter. Rawson testified the dental evidence was “overwhelming” and that this was an “exceptional case” because “[t]here were … more pieces of evidence than you usually see in a bite mark case.”

The Wisconsin Innocence Project arranged for DNA tests and commissioned a review of the dental findings—the DNA analysis excluded Stinson as the source of saliva found on the victim, and the report of the odontologists who reviewed Johnson and Rawson’s work concluded “[they] should have excluded Robert Lee Stinson even based on the methods and standards available [in 1984] … because there is little or no correlation between Robert Lee Stinson’s dentition to the bite marks” (American Society of Forensic Odontology, 2008). Again, Johnson stands behind his findings and has stated that he has seen nothing to suggest that Stinson is innocent (American Society of Forensic Odontology, 2008). This case helps
underscore the problem of a lack of standardization and reliability in expert opinion and testimony in cases involving bite mark evidence.

Dr. Johnson has recently received high profile funding for a controversial project at Marquette where he hopes to establish a “bite-mark” database. In conjunction with this project, he has demonstrated computer software developed at the school that he alleges will allow computer matching of bite marks to suspect’s teeth, though there are skeptics as to whether this will be possible. Dr. Mike Bowers, a leading expert in the field and member of the ABFO calls the work “scientifically illiterate” (Richmond, 2008).

CONCLUSION

In sum, there have been a number of wrongful conviction cases that have involved the improper interpretation of bite mark evidence. Many of these cases are from the late 1980’s and early 1990’s, just before DNA analysis became routinely available, but recent enough that DNA evidence might still exist and have been maintained in a condition such that analysis is still possible. Bite mark evidence has, curiously and unfortunately, been admitted by courts without a critical examination of the procedures, the experts, or the scientific underpinnings of the field. A substantial amount of case law and precedent exists in favor of allowing bite mark evidence, making if difficult (if not impossible) for defense counsel to exclude this evidence. Indeed, inasmuch as is known at this time, bite mark evidence has never been excluded in any court in the U.S.

However, these recent high-profile reversals of bite mark cases upon DNA analysis, could signal a change. Perhaps DNA shows us now that bite mark evidence, though still relevant, is not as reliable as once thought, and maybe the experts are not as expert as we once thought. If we can line up four experts on one side of a case and four equally qualified experts on the other side, and the two sides have diametrically opposed opinions, how good is our “science”? Perhaps it is time for a judge somewhere to finally be the first to say “this bite mark analysis is just not scientific and it’s not reliable, and I’m not letting it come in” thereby greatly diminishing the possibility of wrongful convictions based on the admission of what appears to be a flawed forensic science.
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**BIOGRAPHICAL SKETCHES**

**Roger D. Metcalf** is a forensic dentist in Fort Worth, Texas, and is employed as the Director of the Human Identification Laboratory and Chief Forensic Odontologist at the Tarrant County Medical Examiner's Office. He received the B.S. degree in 1973 from Baylor University, and the D.D.S. degree from Baylor College of Dentistry in 1977. In addition, he completed the Fellowship in forensic odontology at the University of Texas Health Science Center at San Antonio Dental School's Center for Research and Education in Forensics. He is certified by the American Board of Forensic Odontology. Roger received a J.D. degree from Texas Wesleyan University School of Law in May, 2009. While in law school, Roger was an active participant in the Wesleyan Innocence Project reviewing cases at the Dallas County District Attorney's Office, and is also a student member of the Texas Criminal Defense Lawyer's Association. He has testified as an expert witness on forensic dentistry in murder and capital murder trials in Texas.

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**John W. Stickels** received a Doctor of Jurisprudence from Texas Tech University in 1983 and a Ph.D. from the LBJ School of Public Affairs at the University of Texas at Austin in 2003. He is an Assistant Professor in the Criminology and Criminal Justice Department at the University of Texas at Arlington teaching criminal law and procedure, criminology, and statistics and Director and founder of the University of Texas Innocence Network. He is Board Certified in Criminal Law by the Texas Board of Legal Specialization and has over 24 years experience in the criminal justice system including experience as an elected County Attorney of Ward County, Texas, elected District Attorney of the 143rd Judicial District of Texas, and many years experience as both a trial court prosecutor and defense attorney. Dr. Stickels has many criminal and civil jury trials to his credit including several capital murder trials were the death penalty was an option. His research interests are primarily in the areas of wrongful convictions, death penalty issues, and victims in the criminal justice system. His experience in these areas consists of many years of criminal trial experience in both prosecuting and defending criminal cases and resolving problems in the criminal justice system. Dr. Stickels has many peer reviewed publications and presentations to his credit.