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Short communication

Problem-based analysis of bitemark misidentifications: The role of DNA

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Abstract

The dental literature concerning bitemark methodology is surprisingly thin and sorely lacking in rigorous scientific testing. Contra to this fact, the bitemark legal caselaw is surprisingly strong and is used as a substitute for reliability testing of bite mark identification. In short, the Judiciary and the Prosecutors have loved forensic odontologists.

This paper will focus on the author's participation as a Defense expert over the last seven years in over 50 bitemark prosecutions and judicial appeals. This sampling will act as an anecdotal survey of actual bitemark evidence. Certain trends regarding methods and reliability issues of odontologists will be discussed.

Several of these cases have been later judicially overturned due to DNA analyses after the defendants were originally convicted. These diagnostic misadventures are being vocally discussed in the US media by news and legal investigators who are asking hard questions. The forensic dentistry community, however, is curiously silent. What actions are necessary by the profession to improve this assault on the 52-year tradition of bite mark identifications in the United States?

Keywords: Bitemark misidentification; DNA; Erroneous criminal conviction; Validity; Forensic science

1. Review of contemporary bitemark comparison techniques

A 1998 article reviewed five bitemark techniques used to create suspect dental exemplars [1] which are then superimposed [2] onto rectified and life-sized autopsy photographs [3]. The 1998 study ignored ''direct comparison'' methods. This technique of placing plaster models of teeth directly onto or adjacent to postmortem supposed bitemark injuries on human skin was rejected due to the dentist's inability to adequately visualize neither the injury pattern nor the dental minutiae of the dental array. This method had also been previously experimentally studied and considered unreliable [4]. The four most common methods were compared to a ''digital image gold standard'' which produced resulting recommendations to (1) eliminate hand drawn overlay exemplars of suspects' teeth and to (2) use digital images of suspects' teeth acquired through scanning of dental study casts due to greater accuracy.

No contradiction of these suggestions has been noted in the dental literature since their publication. A recent survey of 30 volunteer dentists of varying experience assessed their performance in digital overlay production and found favorable results [5].

As seen in mainstream dentistry, additional tools and therapeutics can be developed for improvement of health care expectations. These new forensic imaging tools have the same purpose. Since being introduced to the profession [6] these new tools have had little use in certain Prosecution bitemark cases seen by this author while acting as a Defense Counsel expert. This disregard of almost 10-year-old scientific literature possibly indicates the established dental experts (trained in the previous Millenium) do not consider common digital procedures will change their opinions or improve their accuracy.

This author's experience is that bitemark misidentifications have resulted from dentists not using high image resolution superimposition or even dental exemplars of any kind. The

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"direct comparison" method appears frequently in a high number of bitemark mis-identifications where convictions have been later overturned by DNA (see Appendix A, LR1). Attitudes have also played a significant role as these same dentists assume every suspect's dental array (including gaps, spaces and accidental enamel chipping) is unique in the human population (LR2).

DNA evidence has been used to clear 172 people wrongly convicted of crimes in 31 states since 1989 (LR3). DNA profiling in the US is having a serious impact on expert bitemark opinions regardless of the traditional bitemark methods or techniques utilized. The following section discusses the legal history of bitemarks in the US court system and will shed some light on the judicial attitudes surrounding established bitemark methods encounter with new scientific scrutiny and the biology of DNA.

2. History of bitemarks in court

Bite mark analysis has been used in the United States courts since 1954 (LR4). In this first legally published case from Texas, a certain Doyle was charged with burglary. At the crime scene, a piece of cheese was discovered that possessed tooth marks. A suspect was captured by the police and asked to bite a piece of cheese to which he voluntarily complied. A firearms examiner compared the two pieces of cheese to investigate similarities or dissimilarities of the tooth marks. This non-dentist concluded the marks were made by the same person. At trial, a testifying dentist made the same conclusion from plaster models of the original crime scene cheese and the defendant's cheese exemplar. Appellate court review accepted this method. In later years, this acceptance was judicially stretched to include tooth marks in skin and occasionally other objects. Still lacking up to today is accompanying scientific validation of the chances for mis-identification in the processes used by court recognized bitemark experts (LR5). This void in scientific support for bitemark identifications reliability was ignored 20 years after Doyle by the Patterson (LR6) court, also in Texas. Both courts ignored the unanswered scientific questions and are mentioned here as a reflection of the persistent U.S. judiciary's avoidance of scientific validation in certain forensic disciplines, with bitemarks being among them. This paper discusses the current legal climate where DNA exonerations of previous bitemark convictions have become the primary fuel to support earlier odontological and legal opinions doubting the reliability of the method.

3. Forensic mistakes in court

A recent article about forensic errors [7] targeted the judicial history of legal miscues, false confessions, witness, police, and scientific testimony in relation to the same cases later becoming DNA exonerations. Fig. 1 shows the distribution of trial court opinion and scientific evidence in 86 convictions that have been overturned in the United States. The original judicial decisions were waived in favor of better investigatory, forensic and biological methods.

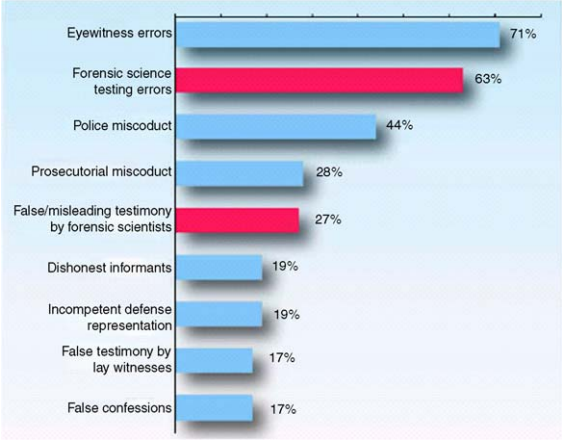

Fig. 1. Saks and Koehler [7] reported that of the 86 DNA exoneration cases they studied, 63% had erroneous forensic science testimony that contributed to the original conviction. They stated published results of bitemark proficiency workshops had false-positive opinions ranging as high as 64% (courtesy to Saks and Koehler [7]).

4. The judicial responses to bitemark evidence in criminal court

Scientific admissibility for bitemark evidence could be changing at some legal levels in States that have changed to the Federal Rules for scientific admissibility established in Daubert v. Merrell Dow Pharmaceuticals (LR7) in 1993. The most recent Daubert reviews in seven U.S. States (LR8), however, indicate no appellate court inclination to tackle ad hoc the underpinnings of bitemark assumptions and methodology. They appear content to expect either the trial court to allow opposing expert testimony or simply wait for DNA results to occasionally appear after conviction to finally settle the questions of guilt.

Proponents of positive biter identification methodology have always and still are (except in the state of Oklahoma) (LR9) allowed to render expert opinions that carry the same evidentiary weight as DNA results (LR10). This fact has fueled many pre-DNA bite mark opinions over the last 52 years that have helped criminal prosecutors influence juries regarding guilt of criminal defendants. The broad-based judicial admissibility of DNA evidence in the US has entered its second decade of use. The judicial problem or task in bitemark identification has always been whether the credentials of the testifying experts meet a modicum of respectability. The questions of science are presented to a jury who weighs the veracity and credibility of the expert. The scientific aspects of reliability are either assumed to be established or the instant case has the expert satisfying the court's threshold of certainty. Little scientific progress can be accomplished by opposing bitemark experts debating their arguments in front of either a judge or jury as the general judicial rationale is the truth will come out during the judicial proceedings. This is an exceedingly poor venue for scientific review as the viewing participants are being asked to consider concepts beyond their knowledge. The ad hominem (adversarial) style of US court proceedings asks the layman jury to accept/reject dental