Bite mark evidence: bite mark analysis is not the same as bite mark comparison or matching or identification

Richard Souviron and Leslie Haller*

Miami-Dade County Medical Examiner Department, Forensic Odontology, Miami, FL 33136, USA
*Corresponding author. E-mail: leslie.haller@gmail.com

INTRODUCTION
There is currently a serious problem with misuse and misunderstanding of bite mark evidence within the larger field of forensic odontology. Saks et al. 1 heralds an impending ‘national dismantling of forensic odontology’. What the paper actually addresses is the very real problem of bite mark comparison, or matching, for purposes of suspect identification. Bite mark comparison, or matching or identification, is by no means the whole discipline of forensic odontology. There is valuable information that can and should be obtained from a bite mark, whether or not it can be, or is, used for comparison purposes.

Forensic odontology includes identification of human remains and age estimation as well as bite mark evidence. Many professionals, including forensic odontologists, confuse themselves and other professionals by mistakenly equating bite mark analysis with bite mark comparison, or matching, for purposes of suspect identification. This misuse of the terms is a serious problem.

DISCUSSION
Following is a discussion of the difference between bite mark analysis and comparison of a bite mark to a suspect’s dentition for purposes of identification.

Analysis
The definition of analysis is: ‘a careful study of something to learn about its parts, what they do, and how they are related to each other’.2 Bite mark analysis is conducted as

1 Michael J. Saks et al., Forensic Bitemark Identification: Weak Foundations, Exaggerated Claims, 3 J. L. BIOSCI. 538–575 (2016).
2 Analysis 2017. In Merriam-Webster.com Retrieved Apr. 16, 2017, from https://www.merriam-webster.com/dictionary/analysis (accessed Apr. 16, 2017).
part of a medico-legal autopsy. This involves objective documentation and interpretation of the evidence surrounding patterned injuries that may, or may not, be bite marks. During bite mark analysis, nothing but the patterned injury and the circumstances surrounding it is taken into consideration. Analysis has nothing to do with comparing or matching anything to a suspect or identification of a suspect from a limited population group. Analysis frequently yields valuable information that forensic odontologists testify to in courts of law, just as forensic pathologists do with respect to their objective findings and their interpretations of those findings based on experience, training and the circumstances of the event.

Bite mark analysis rarely leads to high-profile convictions of suspects, as has sometimes happened when matching or comparing bite marks on a victim to a suspect’s teeth. But it can and does produce information that, when provided to the criminal justice system, can dramatically influence outcomes—for investigators, for prosecutors, and for the defense. In bite mark cases, analysis is the bulk, and most important part, of a forensic odontologist’s work. It should be done before any suspects are introduced for the purpose of making a comparison in order to avoid bias.

The analysis process involves answering basic, crucial, questions such as whether or not the pattern injury is a human bite mark. This question can be the most difficult part of the entire process.3

After establishing whether a patterned injury is, indeed, a bite mark, other questions must be asked. Is it a human bite mark? Was it made by an adult or a child? Was it swabbed for DNA? Was it made through clothing? If so, was the clothing swabbed for DNA? Where is it located on the victim and in what position was the victim when it happened? Could it have been self-inflicted? What was the position of the biter? Was it offensive or defensive? Was it affectionate or does it demonstrate violence? Will it produce a permanent injury? If so, simple battery may become aggravated battery. When was the bite inflicted in relation to the time of death? Is it fresh, a scar or somewhere in between? Was the person bitten alive or dead at the time? Are there any unique dental characteristics that could be used to exclude possible suspects? In cases of multiple bites, did the same biter make them all? Were they all made at the same time or do they establish a pattern of long-term abuse?4

These questions, and more, are the essential core of the analysis of every bite mark, and produce a large amount of information that can be of considerable value to an investigation before any suspects are identified or charged. This information, when combined with other non-dental evidence such as position of the biter vis-à-vis the victim, self-inflicted or not, relation to the time of death or discovery, can aid the prosecution or the defense. In some cases, such as determining battery versus aggravated battery, adult versus child bites, identification of the upper and lower arches, possibility of self-infliction, etc., comparison to a suspect is not even relevant.

3 In several of the, now notorious, overturned conviction cases that involved bite mark comparison, the patterned injury that was said to be ‘indeed and without doubt’ the defendant’s teeth was deemed by other forensic odontologists to not be a bite mark at all. See wrongful conviction cases: Kennedy Brewer, Levon Brooks and Anthony Keko at www.innocenceproject.com (accessed Apr. 16, 2017).

4 WILLIAM E. SILVER & RICHARD R. SOUVIRON, DENTAL AUTOPSY, ch. 13. 157 (2009).
Comparison (or matching or identification)

The definition of comparison is: ‘the act or process of comparing; an examination of two or more items to establish similarities and dissimilarities’. Bite mark comparison is the comparison of a human bite mark to a suspect’s dentition using various methods such as dental models and overlays for purposes of determining whether a suspect can be eliminated from a pool of possible perpetrators. This is not part of a medico-legal autopsy, but rather a separate process done for use by members of the legal system as part of the prosecution of a suspect. There is no doubt that, as Saks et al. clearly describe, bite mark comparison for identification has been seriously misused. Figure 1 shows a flowchart for bite mark analysis. Figure 2 shows a flowchart for bite mark comparison for identification. They are clearly two distinct and very different processes.

Saks et al. are not alone. Much of the research in the field of forensic odontology has been done with respect to evaluating and attempting to improve methods of comparison. In Bitemark Evidence edited by Robert Dorion, the chapter titled Current Context of Bitemark Analysis and Research, there is no discussion of analysis; it only discusses comparison. This explicitly equates comparison with analysis, and overlooks the value of analysis.

In the ABFO Manual of Forensic Odontology 5th edition, the section titled Bitemark Analysis/Bitemark Comparisons states: ‘In general, the forensic odontologists compare exemplars of the teeth of the suspected biter(s) to bitemarks following guidelines and accepted methods’. The ABFO is literally equating analysis and comparison

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5 Comparison. 2017. In Merriam-Webster.com Retrieved Apr. 16, 2017, from https://www.merriam-webster.com/dictionary/comparison (accessed Apr. 16, 2017).
6 Note: They use ‘dental comparison’ to mean bite mark comparison. Dental comparison refers to identifying unknown human remains.
7 ROBERT B.J. DORION, BITEMARK EVIDENCE: A COLOR ATLAS AND TEXT (2011).
8 ABFO Bitemark, 2016, http://abfo.org/wp-content/uploads/2016/03/ABFO-Bitemark-Standards-03162016.pdf (accessed Apr. 16, 2017).
in the section title. Analysis, as previously noted, is the bulk of the work and should be
done before any comparisons are made. Analysis is relegated to a later section titled
Limitations of and Appropriate Use of Bitemark Analysis.

Two papers written by Pretty and Sweet, both respected researchers in the field,
use bite mark analysis in the titles yet focus on comparison within the papers. All of the
areas of concern in the 2009 NAS report criticizing bite mark evidence relate exclusively
to comparison for identification. The ABFO bite mark workshops put most of the
emphasis on how to perform and write an opinion about a comparison of a bite mark
to a series of suspects’ dental models.

Page and Taylor in Context Effects and Observer Bias—Implications for Forensic Odontology also equate bite mark evidence with comparison and bite mark analysis with
the entire discipline of forensic odontology. They discuss the need to limit the amount
of contextual information available to the odontologist doing the ‘analysis’ to minimize
bias. This may be a very good practice for comparison; however, just as forensic pathologists look at history, circumstances of the event and scene photographs in combination
with their personal observation of the body for analysis, forensic odontologists need to
do the same. They need to look at every possible connection with how the patterned
mark was made, or could have been made. This includes access to crime scene photos

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9 Iain A. Pretty & David J. Sweet. The Scientific Basis for Human Bitemark Analyses—A Critical Review, 42 SCI. & JUST. 85–92 (2001).
10 Iain A. Pretty & David J. Sweet. A Paradigm Shift in the Analysis of Bitemarks, 201 FORENSIC SCI. INT. 38–44 (2010).
11 United States, Congress, House, Committee on the Judiciary, Subcommittee on Crime, Terrorism & Homeland Security (2009). National Research Council’s Publication ‘Strengthening Forensic Science in the United States, a Path Forward’: Hearing Before the Subcommittee on Crime, Terrorism, and Homeland Security of the Committee on the Judiciary, House of Representatives, 111th Congress, 1st Sess., May 13, 2009.
12 Mark Page, Jane Taylor & Matt Blenkin, Context Effects and Observer Bias-Implications for Forensic Odontology, 57 J. FORENSIC SCI. 108–12 (2011).
to look for possible items in the area that could have made the mark, what clothing was being worn, what position the body was in, and access to the victim’s medical history to determine if the victim suffered from bleeding or other medical conditions that might have influenced the appearance of the mark.

Limiting contextual information is the opposite of what is appropriate for bite mark analysis. Performing the analysis before evaluating any suspects preserves objectivity and eliminates bias. Silver and Souviron in their book Dental Autopsy\textsuperscript{13} make the following statement of opinion:

If [the odontologist] cannot make an intelligent evaluation of the evidence without a set of teeth to compare, how can he possibly be objective? He can’t. The analysis of the bite mark without a suspect occurs, or should occur, with every case from its inception.

The reason the authors take issue with so much expert opinion is because when documents as important as the 2009 NAS report get it wrong, there is a real risk that admission of valuable information from bite mark analysis into the courts could be lost if ‘all of bite mark evidence’ is disallowed.

Saks et al. do an excellent job describing how the misuse of bite mark comparison came to be.\textsuperscript{14} They describe how originally there was a ‘rule among forensic dentists that crime scene bite marks could not be trusted to yield accurate source identifications’. However, due to the extraordinarily rare circumstances in \textit{People v Marx} (1975),\textsuperscript{15} which did present a legitimate argument for making an exception, the floodgates were opened for all cases of bite mark comparison to be admitted in the future. Saks et al. state as follows:

What had been an exception to the rule magically became the rule, not only for courts but for forensic dentists as well. But, ironically, rather than forensic dentists convincing courts that their field could accurately identify the sources of bite marks, the courts convinced forensic dentists that they could do what until then they doubted they could do.

Thus, the damage was done. Many dentists, with no training at all, stepped into a job that could not actually be done, but they were delighted to be part of the prosecution team with, in some cases, disastrous consequences.

**CONCLUSION**

Of concern is that, because of the undisputed misuse of bite mark comparison, and the unfortunate, but common, belief that bite mark analysis is the same as bite mark comparison, valuable information available to the criminal justice system from bite mark analysis may be deemed inadmissible in a court of law—unless experts in the field wake up to the distinction between comparison and analysis, and communicate that distinction to the legal system.

\textsuperscript{13} WILLIAM E. SILVER & RICHARD R. SOUVIRON, DENTAL AUTOPSY (2009).
\textsuperscript{14} Id.
\textsuperscript{15} 54 Cal.App. 3d 100, 126 Cal. Rptr. 350, 77 A.L.R.3d 1108 (2nd Dist. 1975).
There is no doubt that the situation requires remediation. However, it is important that over-reaction be avoided. First, eliminating all of bite mark evidence because of the misuse of one part, would be a serious mistake equivalent to the proverbial throwing the baby out with the bath water. Second, the authors of this paper agree that, with rare exception, bite mark comparison is not able to identify a suspect with a reasonable degree of certainty. However, under some circumstances bite mark comparison can be useful for the exclusion of suspects. The circumstances where exceptions could be made should be clearly and carefully identified and adopted within forensic odontology and the law.