G26 Bitemark Analysis and Comparison: Science, Observation, and Opinion

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After attending this presentation, attendees will learn the scientific rational behind bitemark analysis.

This presentation will impact the forensic science community by explaining the scientific literature that supports the underpinnings of bitemark analysis. The examiner may then observe and form an opinion regarding the patterned injury.

Many people believe that bitemark analysis is a single process; however, knowledgeable forensic odontologists understand that it is actually two processes, with the second predicated on the outcome of the first. The analysis is to determine whether the patterned injury in question is actually a bitemark. If so, then one proceeds to the second process — comparison of the bitemark to suspected biters. If the patterned injury is determined not to be a bitemark, or if there is insufficient evidence to make a determination, the process ends without a comparison. As a matter of fact, most patterned injuries that are analyzed never get to the comparison stage for the reasons outlined above.

Since the release of the National Academy of Sciences (NAS) Report in 2009, Strengthening Forensic Science in the United States: A Path Forward, there has been much criticism of the use of bitemark evidence. Some of these criticisms are valid and some are not. One of the most often heard critiques of bitemark evidence is that it is "not real science." In the sense that it is not measurable like DNA analysis and toxicology, there can be no doubt. Nevertheless, like many other forensic disciplines, it has scientific underpinnings along with observational opinions. Opinions given by medical examiners regarding the cause and manner of death would fall into the same category, because they are based on scientific principles that are combined with observations and experience to reach an opinion. In short, these opinions are not based on benchtop or laboratory science.

Bitemark analysis and comparison involves the use of scientific information, some of which is measureable. The initial stages of bitemark analysis usually include measurement of arch and tooth sizes. There is scientific data to support the use of human arch and tooth sizes in dental and orthodontic literature. In addition to measurement of arch and tooth sizes, histological examinations are sometimes used to determine whether an epidermal abnormality has subdermal hemorrhage and to determine relative aging of a patterned injury. All of these procedures are measureable scientific methods. The observational part of bitemark analysis and comparison is subjective and involves interpretation of arch and tooth shapes. Comparisons of suspected biters with the bitemark involve observation of consistencies and inconsistencies between the bitemark and the suspected biter. Inconsistencies are usually more significant than consistencies. An explainable inconsistency does not exclude a suspected biter; however, an unexplainable inconsistency is the basis for exclusion of a suspected biter.

The opinion part of bitemark analysis and comparison is a combination of measurement, observation, and experience. Experience does play a role in this part of this process, especially when deciding how much weight to give individual characteristics and distinct features of bitemarks. This part does not lend itself to scientific study because each injury is created in a different environment and cannot be directly compared to another case. The vast majority of opinions in bitemark analyses result in inclusion or exclusion of suspected biters. This may not have been the case during the time that most DNA exonerations occurred (prior to 1995), but forensic odontologists have recognized the limitations of their science. In addition, the American Board of Forensic Odontology (ABFO) has been proactive in correcting some of the problems with previous bitemark opinions. The ABFO has enacted or recommended the following changes within the past five years: (1) the blinding of bitemark evidence — the bitemark analyst should not collect the dental evidence from suspected biters; (2) the use of second opinions in bitemark comparisons; and, (3) the ABFO does not sanction the use of the strongest linkage opinion (the biter) in an open population.

In conclusion, bitemark evidence has significant value when used under the following circumstances: (1) the bitemark has substantial evidentiary value; (2) the population of suspected biters is relatively small; and, (3) the bite patterns of the suspected biters are distinctly different. The opinions that result from bitemark analysis and comparison can include suspected biters or exclude them. These opinions can provide valuable assistance in the determination of judicious outcomes for criminal suspects.

Bitemarks, Science, Opinion

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