



### E46 Review of the Scientific Basis of Bitemark Comparison: Post-NAS Report

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The goal of this presentation is to explore basic research in bitemark analysis published since the release of the 2009 National Academy of Sciences (NAS) Report.

This presentation will impact the forensic science community by providing a summary of the current status of the scientific basis for this forensic discipline.

The 2009 NAS Report was critical in its assessment of bitemark comparison. Lack of research supporting the basic tenets of this technique was noted. The tenets are that the human dentition is unique and that the unique features transfer to the skin; however, at time of publication of the NAS Report, systematic studies supporting these basic suppositions were conspicuously lacking. As per the NAS Report, "the uniqueness of the human dentition has not been established, the ability of the features of the dentition to transfer to the skin has not been established, and the scope or extent of distortion has not been demonstrated."

Admittance of a technique into the courtroom when there are few systematic studies to support its validity can have negative consequences, as exemplified by a number of exoneration cases. When life and liberty are at stake, there is a responsibility to base testimony on substantiated techniques with a clear understanding of the limitations of the approaches used. When testimony is not grounded in systematic scientific studies, interpretation can become subjective rather than objective.

Given the concerns stressed in the NAS Report, and the serious consequences seen in the courtroom, it would stand to reason that research is warranted to evaluate the basis of bitemark analysis. Current research is exploring these questions and the results are pointing to a cautionary view of bitemark analysis as a means of identification. Those results indicate that there is a large degree of distortion possible in human skin and that relatively small collections of human anterior dentitions contain multiple dentitions with differences below achievable measurement resolution. The inability to distinguish between these dentitions creates questions about the notion of uniqueness within this class of forensic data.

Many of the details that make the dentition as a whole distinct for victim identification are not present in a bitemark, creating further limitations on the ability to individuate in this circumstance. As such, it may be more appropriate to consider the extent to which distortion would include similar suspect dentitions in a bitemark, given the loss of resolution encountered in skin, and whether it is still possible to make distinctions in small, closed populations.

It is inevitable that a degree of distortion will be seen in a bitemark. Human skin is a poor recording medium as it exhibits a visco-elastic, anisotropic response to stress. Skin tension lines dictate the extent to which skin can stretch. These tension lines vary across the body and can be altered depending on body movement. Given this property of skin, it should not be surprising to see a large range of distortion. Results demonstrated that the maxillary and mandibular arches distort independently as impressed in a bitemark, meaning that the distortion in one arch is not reflective of the distortion seen in the other. Furthermore, it has been observed that multiple bites, all made with the same dentition will vary widely in the pattern seen, and that other dentitions, which did not inflict the bite, may be a better candidate than the biter.

Bitemark analysis has a long history in the legal system and it is inarguable that mistakes have been made, resulting in incarceration of innocent people. The new level of scrutiny of forensic evidence will demand fresh examination of the scientific basis and admissibility of bitemark comparison.

**Bitemarks, Bitemark Research, NAS Report**