Bitemarks

Presentation, Analysis, and Evidential Reliability

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CONTENTS

INTRODUCTION
PREVALENCE AND PRESENTATION
BITEMARKS IN FOOD
PROPERTIES OF SKIN AND TEETH
DIGITAL EVALUATION OF BITEMARKS
SALIVARY ANALYSIS
EVIDENTIAL RELIABILITY OF BITEMARK ANALYSIS
REFERENCES

SUMMARY

A bitemark is the physical end product of a complex set of events that occur when human or animal teeth are applied to skin or foodstuff. Despite its long history of admission as evidence, there remains a number of significant challenges to its evidential usefulness. Principal among these are the presumed uniqueness of the human dentition, the variable visco-elastic properties of
human skin, and the qualitative nature of bitemark analysis. In this chapter, we outline these and other issues and we review the newly described bacterial fingerprinting technique.

**Key Words:** Bitemark; evidence; human dentition; digital evaluation; animal bites; postmortem damage; salivary analysis; *Streptococcus*; Daubert; Frye.

1. **Introduction**

A bitemark may be defined as the physical alteration on a surface such as skin or food that is caused by the dentition of a human or animal. A bitemark is the end product of a highly complex set of events that includes the closure of the mouth, movements of the victim, the angle of approach, and the force exerted by the biter. This is further complicated by factors such as the positioning and state of the biting teeth, the biter's temporomandibular joint and occlusion, and the visco-elastic properties of the material bitten. The analysis of bitemarks has a long history, dating back to the trial of the Reverend George Burrows, who was accused of torturing and soliciting two young women into witchcraft in 1692 (1). Other early cases include *Ohio vs Robinson* of 1870, in which Dr. Robert Taft testified that he had examined marks left on the murdered Mary Lunsford's arm and found that they were toothmarks, and the 1906 case at the Cumberland Assizes at Carlisle, where a burglar was convicted on the basis of a comparison of his teeth and the marks left on a piece of cheese (2). The recent revival of interest in bitemark analysis followed two technological advances. First, the use of polymerase chain reaction (PCR)-based typing of DNA present in the saliva either on human skin or on food-stuff, which is then compared with the DNA profile of the suspect (3,4) and, second, the use of digital imaging techniques to facilitate bitemark analysis (5,6). It has been argued that bitemark analysis may not be as accurate as it has been claimed (7). This argument was supported by those who claimed that the human dentition was in fact not as unique as was previously supposed (8), that it was impossible to determine who else in the broader population could have produced a bite similar to the one under investigation (9), or that some overlay methods of analysis were inaccurate and subjective (7,10). However, it has recently been suggested that genotypic comparison of oral streptococci might be used in bitemark analysis (11) and also that if it is acknowledged that bitemark analysis is qualitative that this evidence might be used for selecting a perpetrator from a small group of suspects (12).

This review is divided into six parts. First, we consider the presentation of human and animal bitemarks; second, we look at bitemarks in food; third,