Annotated Bibliography of the Peer Reviewed Literature concerning Bitemark Analysis

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This bibliography is comprehensive, but is known not to be complete. The authors feel, however, that the majority of significant publications are represented.

The primary and secondary literature is covered (peer-reviewed original papers and review articles). The tertiary literature is not covered (books).

Bibliography:

1. 1960 Fearnhead RW. Med Sci Law; 1:273-77 Facilities for forensic odontology. Describes the use of hand drawn acetate overlays. Draws the conclusion that "evidence which involves the identification of a person by tooth-marks left as bruises in flesh should never be admitted". Describes simple experiment. One of the first papers to question the use of bitemark evidence based upon the reliability of the technique.

2. 1963 Taylor DV. Brit Dent J; 114:389 The law and the dentist. Written by a dual qualified dentist and lawyer. Describes all aspects of forensic dentistry, including bitemarks. States "...unlikely to establish convincing proof in most cases".

3. 1966 Layton JJ. J Forensic Sci Soc; 6:76-80 Identification from a bitemark in cheese. A bitemark in cheese found at a crime scene. Control bitemark made in similar cheese by the suspect and twenty points of similarity are discussed. Suspect admitted guilt. States that BMs can never be as positive as fingerprints.


5. 1968 Furness J. Br Dent J; 124(6):261-7 A new method for the identification of teeth marks in cases of assault and homicide. Paper describes the inking of the occlusal surfaces of the teeth which are then photographed and placed on white board. Lines of comparison are drawn with photographs of the injury. Technique is still used today for court exhibits depicting bitemark comparisons.

6. 1969 Furness J. J Forensic Sci Soc; 9:126-75 Teeth marks and their significance in cases of homicide. Paper claims to differentiate between marks made in self-defence, those made sadistically and "love-nips". Unconvincing. Numerous case examples given. There is somewhat of a debate on the psychology of biting and the inferences that can be made about an attacker from the injury.

7. 1970 Hodson JJ. Med Sci Law; 10(4):247-51 Forensic odontology and its role in the problems of the police and forensic pathologist. Paper outlines the value of forensic dentistry to the police. Recommends the type of dentists who should be called to assist. Summarizes with case reports including a bitemark case on two young children.

8. 1970 Levine LJ, Beaghler RL. NY State Dent J; 36(9):539-42 Forensic odontology - a routine case and commentary. This paper, written for the general practitioner, mentions bitemarks only in passing. The majority of the paper is devoted to an identification case.


10. 1971 DeVore DT. Med Sci Law; 11(3):144-5 Bitemarks for identification? A preliminary report. Author used ink models to place marks on living volunteers and cadavers. Photographs of the marks were taken in several body positions. Skin from the cadavers bearing the ink was excised. Paper concludes that there is a large margin of error in using bitemark photographs and unsecured excised skin. States that the exact position of the body when bitten must be known and replicated. A useful study. Little attention has been paid to this paper that encourages caution when examining bite injuries.


14. 1973 Woolridge ED. Int J Forens Dent; 2(1):6-12 Significant problems of the forensic odontologist in the USA. Describes some of the legal issues that
surround forensic dentistry. This topic has been addressed in more contemporary articles.


23. 1974 Barbanel JC, Evans JH. J Forensic Sci Soc; 14(3):235-8 Bitemarks in skin - mechanical factors. Describes the mechanical factors used to produce a bite, including tongue pressure and suction. States that the properties of particular skin area bitten may affect the appearance of a bitemark. Clear and concise coverage of the topic that has not been addressed since.

24. 1974 Millington PF. J Forensic Sci Soc; 14(3):239-40 Histological studies of skin carrying bitemarks. Histological examination of bites from both living and deceased individuals. States that complete recovery of a bite injury may take 2 or 3 weeks. States that the use of histology in determining the time of the injury may be helpful. The ageing of wounds, and in particular bitemarks, is still debated.


29. 1975 Solheim T, Leidal TI. Forensic Sci; 6(3):205-15 Scanning electron microscopy in the investigation of bitemarks in foodstuffs. In this study students with no obvious irregularities on their anterior teeth were asked to bite various foodstuffs. Using SEM the marks were analysed and the authors concluded that as many individual characteristics were visible the technique was useful in forensic investigations. An interesting technique, although infrequently used in case work.

30. 1975 Whittaker DK. Int Dent J; 25(3):166-71 Some laboratory studies on the accuracy of bitemark comparisons. Author studied bites in wax and on pig skin. Found that those on pig skin were less reliable than those on wax in terms of bite identification. Highest accuracy found was 76%. Extrapolates that bites on human skin may be similarly unreliable; offers a warning that more research is required. Highly cited paper - often regarded as one of the first attempts to validate the science of bitemark analysis. Warning went unheeded.

32. 1976 Bang G. Acta Odontol Scand; 34(1):1-11 Analysis of tooth marks in a homicide case. Observations by means of visual description, stereo-photography, scanning electron microscopy and stereometric graphic plotting. Author was asked to re-examine a bitemark case involving an injury to a breast. Using novel techniques, including SEM, the author found that the originally convicted individual was the likely biter.

33. 1976 Anderson WR, Hudson RP. Forens Sci; 7(1):71-4 Self inflicted bitemarks in battered child syndrome. Victim of child abuse victim had bitemarks on both arms. Authors demonstrated that the bite was from the victim. Importance of this phenomenon in evaluation of bite injuries is discussed. Used transparent overlays in analysis. Established that bites can be self-inflicted.

34. 1976 MacDonald DG, Laird WR Int J Forensic Dent; 3(10):26-30 Bitemarks in a murder case. Case report describing a murder involving a bite to the abdomen and breast. Authors describe the use of statistics to determine the number of individuals capable of producing the bite. Statistical evidence was presented in court. Use of statistics is interesting in this case. Arrived at a figure of 1 in 62 million. It must be noted that approximately half of the Scottish population were edentulous at this time.

35. 1976 Sognnaes RF. Int J Forensic Dent; 3(0):14-6 Dental science as evidence in court. Describes some applications of forensic dental techniques in court.


37. 1976 Vale GL, Sognnaes RF, Felando GN, Noguchi TT. J Forensic Sci; 21(3):642-52 Unusual three-dimensional bitemark evidence in a homicide case. Describes a case of bitemark identification. Bite was on victim's nose. Authors concluded a positive match and this became the first case in Californian Law using bitemark evidence.


43. 1977 Sognnaes RF. New Eng J Med; 296:79-85 Forensic stomatology. Three part series. Sognnaes reviews the forensic literature in a three part series as part of the Medical Progress section. Various methods of forensic evaluation of bitemarks are discussed.


46. 1979 Morrison HL. J Forens Sci; 24(2):492-502 Psychiatric observations and interpretations of bite mark evidence in multiple murders. Interesting paper in which the author describes over 400 hours of contact time with a serial murder who bit many of his victims. Whilst not answering "why do people bite?" author raises interesting questions. The psychological aspects of bitemarks are yet to be firmly established.

47. 1979 Rawson RD, Bell A, Kinard BS, Kinard JG J Forens Sci; 24(4):898-901 Radiographic interpretation of contrast-media-enhanced bite marks. Describes a techniques of radiographing soft-tissue that has been removed from cadavers. Study used postmortem bits.


A personal recollection of a forensic dentist, describes case work and issues around bitemarks in English law. No papers cited.


57. 1982 Webster G. Forensic Sci Int; 20(1):45-52 A suggested classification of bitemarks in foodstuffs in forensic dental analysis. Author states that it is the labial surfaces rather than the biting edges that are responsible for bitemarks in food. Webster suggests an alternate terminology to bring uniformity in describing such evidence. Bitemarks in food are rare in criminal cases, although recently cheese has yielded DNA from a bite.

58. 1982 Sognnaes RF, Rawson RD, Gratt BM, Nguyen NB. JADA; 105(3):449-51 Computer comparison of bitemark patterns in identical twins. Using computer technology and radiographic bitemark analysis the authors conclude that occlusal arch form and individual tooth positions, even in identical twins are in fact unique. This paper is frequently cited as evidence of dental "uniqueness". Highly cited paper, frequently used as part of the dental uniqueness argument.

59. 1982 Rudland M. Med Sci Law; 22(1):47-50 The dimensional stability of bitemarks in apples after long-term storage in a fixative. Paper describes the method for preserving a variety of apple types. Used a pre-defined mark which was examined over a period of ten years, with little distortion noted.

60. 1983 Irons F, Steuterman MC, Brinkhous W. Am J Forensic Med Pathol; 4(2):177-80 Two bitemarks on assailant. Primary link to homicide conviction. Two bitemarks were found on a suspect in a homicide. The authors state that the injuries matched the victims' teeth and the suspect pled guilty to the offence.


63. 1983 Deming JE, Mittleman RE, Wettl CV J Forens Sci; 28(3): 572-6 Forensic science aspects of fatal sexual assaults on women. The authors review the case files of 41 female victims of proven fatal sexual assault. Describe bitemarks as not infrequent in such crimes.


67. 1984 Corbett ME, Spence D. Br Dent J; 157(8):270-1 A forensic investigation of teeth marks in soap. A bite mark in soap was used as evidence in the prosecution of a homicide of a 2 year old girl.

68. 1984 Elliot TR, Rogers AH, Havercamp JR. Groothuis D. Forens Sci Int; 26(2):131-7 Analytical pyrolysis of Streptococcus salivarius as an aid to identification in bitemark investigation Authors describe "finger-printing" strains of Streptococcus salivarius. The results of the analysis of isolates from two individuals are presented, illustrating the differentiation of S. salivarius at strain level according to the origin of the isolate.

69. 1984 Brown KA, Elliot TR, Rogers AH, Thonard JC. Forensic Sci Int; 26(3):193-7 The survival of oral streptococci on human skin and its implication in bitemark investigation. Authors describe their experiments for recovering bacteria from saliva. Found that after 24 hours on skin viable bacteria could still be removed.
Preservation and fixation of skin for future scientific evaluation and courtroom presentation. Describes a method for removing and preserving human skin exhibiting bite injuries. Author uses acrylic which is placed on the skin, cyanoacrylate glue used to stick the acrylic ring to the skin and the tissue excised. Three year preservation achieved little or no post fixation shrinkage. No discussion of how the lack of shrinkage was assessed. Numerous photographs illustrate the procedure well.

Photographic techniques of concern in metric bite mark analysis. Author advises the use of a rigid ruler for scale, proper camera positioning in relation to the scale, and a method to evaluate the distortion in a two-dimensional print that records a three-dimensional object is suggested. Disregarding these factors makes metric bite mark analysis inappropriate.

Statistical evidence for the individuality of the human dentition. A general population sample of bite marks in wax was used to determine how unique bites are. Authors conclude that the analysis confirms the unique nature of human bites. Seminal paper, but incorrectly assumed that tooth position is uniformly distributed and not correlated. Used the product rule to calculate probability. Refuted by Bush et al, 2011.

Incidence of bitemarks in a selected juvenile population: a preliminary report. A study of the frequency of bite marks among sheltered children. Found an incidence of 1545 bite marks per 100 000 population. Analysis of the age, sex, and location of bite marks is presented.

Presentation of bitemark evidence resulting in the acquittal of a man after serving seven years in prison for murder. Author describes case in which he appeared for the defense with another odontologist testifying for the prosecution. 3 months of bitemark analysis.

Dusting and lifting the bite print: a new technique. Utilizing the powder and brush method employed in lifting fingerprints, one of the authors was able to lift tooth prints on the body surface of both living and dead victims. Possibly a useful technique but never revisited.

Combination review and study of statistical probability of dental configurations. Found 4% match rate in two out of three populations studied.


The role of photography in the presentation of bitemark evidence. Paper explains the various photographic techniques that can be used with bitemark evidence.


Two bitemark cases with inadequate scale references. Both cases illustrate that a technical infraction in processing and recording bite marks, though serious, need not automatically disqualify the analysis.


Adjunctive use of scanning electron microscopy in bitemark analysis: a 3D study. Case report in which adjunctive use of scanning electron microscopy (SEM) demonstrated the presence of
unusual three-dimensional characteristics in a bite mark. Technical problems with images.


88. 1986 Rawson RD, Vale GL, Sperber ND, Herschaft EE, Yfantis A. J Forens Sci; 31(4):1235-60 Reliability of the Scoring System of the American Board of Forensic Odontology for Human Bite Marks. The various methods of determining the validity of the scoring guide are presented with statistical data generated from scores reported by recognized forensic science experts. States that this paper represents the first truly scientific approach to bitemark analysis. Emphasize the need for peer review. The paper was ultimately disregarded as overly complex and the system never gained credibility with forensic dentists.

89. 1986 ABFO Inc. JADA; 112:383-6 Guidelines for bitemark analysis. This paper, written by the members of the Bite Mark Committee, presents guidelines for the proper investigation of bite injuries. The article cites Hale's 78 paper as an instigator in the process of establishing protocols. These guidelines include a discussion of the controversial bitemark scoring system. Despite being described as "dynamic" these guidelines were not updated.


95. 1987 Dorion RB. J Forens Sci; 32(3):690-7 Transillumination in bite mark evidence. Author describes the value of using transillumination in the examination of bitemarks. Author describes the technique's use when bites are poorly defined, barely visible, or obscured by other superimposed bite marks or traumatic injury patterns. Controversy surrounds the removal of tissue from victims of crime. Does the increase in evidentiary value justify this mutilation?


97. 1988 Hyzer WG, Krauss TC. J Forensic Sci; 33(2):498-506 The Bite Mark Standard Reference Scale--ABFO No. 2. The ABFO scale is now universally adopted by not only forensic dentists but also many other forensic professionals. This paper describes the design and constructional features of the scale and offers guidelines for its effective application to bite mark photography. Paper describes an important tool in BM investigations.


99. 1988 Vale GL, Rawson RD. J Forensic Sci; 33(1):20 Discussion of "Reliability of the scoring system of the ABFO for human bitemarks" A "back-track" from the scoring system, advising caution when using the index and recommending more research. Brought to an end the point system - no further work was carried out.


101. 1989 Gundelach A. J Forensic Odont;7(2):11-6 Lawyers' reasoning and scientific proof: a cautionary tale in forensic odontology. Describes a legal case and states that a cautious approach to bitemark evidence should be taken. Yet another paper which advises caution when using bitemark evidence. Little attention paid to such articles.


104. 1990 Whittaker DK Dental Update; 17(9):386-90
Principles of forensic dentistry: 2. Non-accidental injury, bite marks and archaeology. The paper reviews the role of the forensic dentist with respect to non-accidental injury to children, analysis of bite marks, and archaeological investigations. Another review on this subject.

105. 1990 West MH, Barsley RE. Mississippi D Ass J; 46(4):7, 11-2 First bite mark convictions in Mississippi. Case reports of bitemark cases in this State.

106. 1990 West MH, Barsley RE, Fair J, Seal MD. J Forensic Sci; 35(6):1477-85 The use of human skin in the fabrication of a bite mark template: two case reports. In this article skin was used as a template for the reproduction of a bite. In one case the victim’s skin was used; in the other, the skin of a anatomically similar person was used. The use of inked dental casts, photography, and transparent overlays significantly reduced the errors common to analysis of bite marks in these highly curved areas. Novel technique although not well accepted.


108. 1990 Barsley RE, West MH, Fair JA. Am J Forensic Med Pathol; 11(4):300-8 Forensic photography. Ultraviolet imaging of wounds on skin. This article discusses the photographic techniques involved in reflective and fluorescent UVL. Documentation of skin wounds via still photography and dynamic video photographic techniques, which utilize various methods of UV illumination, are covered. The use of advanced photographic techniques has been questioned in courts.


110. 1991 Dailey JC. J Forensic Sci; 36(2):565-70 A practical technique for the fabrication of transparent bite mark overlays. A quick, inexpensive, and accurate technique for generating transparent overlays, using office photocopy machines, for use in bite mark case analysis is presented. Photocopy technique was the 1st attempt to produce an objective overlay with precision.

111. 1992 Robinson E, Wentzel J. J Forensic Sci; 37(1):195-207 Toneline bite mark photography. A high-contrast film technique previously used primarily in the graphic arts field has been refined and applied to forensic odontology.

112. 1993 Mailis NP. J Forensic Odont; 11(1):31-3
Bitemarks in forensic dental practice: the Russian experience. Cases from Russia are described.

113. 1993 Figgener L. J Forensic Odont; 11(2):71-5
Points of contact between quality issues and forensic aspects. Issues related to jurisprudence.

114. 1994 Ligthelm AJ, van Niekerk PJ J Forensic Odont; 12(2):23-9 Comparative review of bitemark cases from Pretoria, South Africa. The purpose of this study was to record the experiences with bitemark cases presented to forensic odontologists at the University of Pretoria from 1993-93 and to compare them with trends and findings elsewhere. Some details on anatomical locations may be useful.

115. 1994 Wood RE, Miller PA, Blenkinsop BR. J Forensic Odont; 12(2):30-6 Image editing and computer assisted bitemark analysis: a case report. Three different approaches for comparison with the bitemark photograph were utilized: comparison with radiographs of amalgam-filled impressions of dental casts, a transparent overlay technique and comparison with photographs of a simulated bitemark inked onto the hand of a volunteer.

116. 1994 Thompson IO, Phillips VM. J Forensic Odont; 12(2):37-40 A bitemark case with a twist. This is a case report in which the bite patterns of two suspects were compared to a bitemark on the breast of a murder victim. Each suspect had sufficient concordant features to have been found guilty of producing the bitemark. The irony in this case is that the bitemark was not inflicted by the murderer.

117. 1994 Aboshi H, Taylor JA, Takei T, Brown KA. J Forensic Odont; 12(2):41-4 Comparison of bitemarks in foodstuffs by computer imaging: a case report. Marks in cake discovered at a crime scene were examined and compared with the teeth of a suspect arsonist. The comparison was made by computer imaging analysis and a remarkable similarity in arch shape was observed.

118. 1994 Jessee SA Paediatric Dentistry; 16(5):336-9
Recognition of bite marks in child abuse cases. Health professionals must be attentive to any and all signs of child maltreatment. Bite marks are one of several visual expressions of active child abuse. Another paper describing this important issue.


123. 1995 Nambiar P, Bridges TE, Brown KA. J Forensic Odont; 13(2):18-25 Quantitative forensic evaluation of bite marks with the aid of a shape analysis computer program: Part 1; The development of "SCIP" and the similarity index. In this study, an interactive shape analysis computer program ("SCIP"-Shape Comparison Interactive Program) has been employed in an attempt to derive experimentally a quantitative comparison, in the form of a Similarity Index (S.I.), between the "offender's" teeth and the bite marks produced on a standard flat wax form.

124. 1995 Nambiar P, Bridges TE, Brown KA. J Forensic Odont; 13(2):26-32 Quantitative forensic evaluation of bite marks with the aid of a shape analysis computer program: Part 2; "SCIP" and bite marks in skin and foodstuffs. In this study, "SCIP" was employed in an attempt to quantify the comparison, in the form of a Similarity Index (S.I.), between the "offender's" teeth and the bite marks produced on foodstuffs and on human skin, under experimental conditions.


126. 1995 Jakobsen J, Holmen L, Fredo L, Sejrsen B. J Forensic Odont; (13)2:36-40 Scanning electron microscopy, a useful tool in forensic dental work. Another description of the use of SEM in bitemarks, presents four example cases.

127. 1995 Rothwell BR. JADA; 126(2):223-32 Bite marks in forensic dentistry: a review of legal, scientific issues. This review article explores the legal and scientific basis of bite mark evidence.


132. 1996 Aksu MN, Gobetti JP. Am J Forensic Med Pathol; 17(2):136-40 The past and present legal weight of bite marks as evidence. Legal review. This paper was followed by a letter from Ann Norrlander who criticised many of the points. Better legal reviews available.


134. 1997 Williams RG, Porter BE. J Oklahoma Dent Assoc; 88(2):29-30 Forensic dentistry. Documentation of bite-mark evidence using multiple computer-assisted techniques. Describes a computer technique - however describes using a pencil to highlight the incisal edges prior to scanning - subjective?


136. 1998 Sweet D, Pathar M, Wood RE. J Forensic Sci; 43(5):1050-5 Computer-based production of bite mark comparison overlays. This paper describes this technique to enable the odontologist to produce high-quality, accurate comparison overlays without subjective input.

137. 1998 Wright FD. J Forensic Sci; 43(4):881-7 Photography in bite mark and patterned injury documentation. Part 2: A case study. The evidence recovered at each photography session is discussed and photographs are presented for review. Suggestions concerning the need for more research are presented.

138. 1998 Sweet D, Bowers CM. J Forensic Sci; 43(2):362-7 Accuracy of bite mark overlays: a comparison of five common methods to produce exemplars from a suspect's dentition. Five common overlay production methods were compared using digital images of dental study casts as a reference standard.

140. 1998 Whittaker DK, Brickley MR, Evans L. Forensic Sci Int; 92(1):11-20. A comparison of the ability of experts and non-experts to differentiate between adult and child human bite marks using receiver operating characteristic (ROC) analysis. Fifty colour prints of human bite marks were sent to 109 observers who were asked to decide using a six point rating scale, whether the marks had been produced by the teeth of an adult or a child. Non-experts had similar performance to experts.


147. 2001 Pretty IA, Turnbull MD. Lack of dental uniqueness between two bite mark suspects. Urges caution due to similarity of dentitions.


154. 2001 Arheart, K. L. and I. A. Pretty (2001). "Results of the 4th ABFO Bitemark Workshop-1999." Forensic Science International 124(2-3): 104-111. Reports results of an ABFO blind study workshop using ROC analysis. Paper has contradictory language stating that forensic pattern analysis is subjective and not an exact science, but also that bitemark examination is an accurate technique. The results as described can be interpreted in several ways.


103-106. Exploration of behavioral aspects of biting.


170. 2006 Pretty IA. For Sci Int 159;1 S110-120. The barriers to achieving an evidence base for bitemark analysis. Review stating urgent need for further studies to achieve scientific basis.


172. 2006 Al-Talabani et al. Digital analysis of experimental human bitemarks: Application of two new methods. J Forensic Sci 51:6, 1372-5 In the only empirical study of its kind, 50 living volunteers were bitten. Study concludes that it was difficult to distinguish biters due to gross similarity of the dentitions.


186. 2009 Bush MA, Miller RG, Bush PJ, Dorion RBJ. Biomechanical Factors in Human Dermal Bitemarks in a Cadaver Model J Forensic Sci, 2009; 54(1):167-76. First serious consideration of skin properties. 23 bites were made with the same dentition in cadaver skin, none were measurably the same. Postural distortion was also studied and found to be significant. Bitemarks were not reproducible. Landmark paper using cadaver model.

187. 2009 Miller RG, Bush PJ, Dorion RBJ, Bush MA. Uniqueness of the Dentition as Assessed in Human Skin: A Cadaver Model. J Forensic Sci, 2009;54(4):909-14. 100 models were compared to bitemarks made with 10 dentitions with different alignments. Results showed difficulty distinguishing the biter from individuals with similarly aligned dentitions and in some cases, an incorrect biter appeared better correlated to the bite. Cautionary paper empirically demonstrating unreliability of bitemark analysis.


192. 2010 Bush MA, Cooper HI, Dorion RBJ. Inquiry into the Scientific Basis for Bitemark Profiling and Arbitrary Distortion Compensation J Forensic Sci 2010; 55(4):976-83. Discussion with examples of why it is not appropriate to profile a biter from a bitemark or make universal distortion correction.


197. 2011 Heras S, Tafur D. Validity of a dichotomous expert response in bitemark analysis using 3-D technology. Science and Justice 51 (2011) 24–27. Study explores decision-making process. However, this and a previous study (Heras 09) used the same set of 13 dentitions, selected because they were distinct from each other. It is no surprise that it was possible to match biter with dentition.


200. 2011 Bush MA, Bush PJ, Sheets HD. Statistical Evidence for the Similarity of the Human Dentition. J Forensic Sci, 2011;56(1):118-23. Refutation of Rawsons 1984 study that claimed dental uniqueness. Two dental populations of 172 and 344 were examined for match rates. Statistics were used that took into account dental correlation and non-independent nature of the human dentition. Matches were found in the populations studied. Study suggests that the dentition is not unique as measured.


202. 2011 Bush MA, Bush PJ, Sheets HD. Similarity and Match Rates of the Human Dentition In 3 Dimensions: Relevance to Bitemark Analysis. International Journal of Legal Medicine published online 4 September 2010. Match rates determined in a population of 500 dentitions using 3D models and shape analysis. Significant numbers of matching dentitions were found. The effect of 2D vs 3D measurement on match rate was also explored (match rate lowered when 3D included). This and prior studies showed that dental match rate is population-dependent.
