

Bite Marks: A new Identification Technique

B Rai, S Anand, M Madan, S Dhatarwal

Citation

B Rai, S Anand, M Madan, S Dhatarwal. *Bite Marks: A new Identification Technique*. The Internet Journal of Forensic Science. 2006 Volume 2 Number 1.

Abstract

Bite mark analysis is a vital area within this highly specialized field and constitutes the commonest form of dental evidence presented in criminal court. In this study, identification of the person was done through bite mark by different techniques using life size photographs; transparent overlays from study dental cast models in different materials such as clay and cheese.

INTRODUCTION

Forensic odontology has emerged as one of the most important offshoots of forensic medicine. It has proved to be invaluable in criminal investigations of different types including rape, child abuse and murder. Bite mark analysis is a vital area within this highly specialised field and constitutes the commonest form of dental evidence presented in criminal court. They were the oldest evidence used, even by God when he came to know about the "first sin" by looking at the bite marks on the apple.¹ The first formally reported case of dental identification was that of the 80 year old English warrior John Talbot, Earl of Shrewsbury, who fell in the battle of Castillon in 1453.² The earliest recorded criminal case involving bite mark analysis was an American case (State of Ohio vs. Robinson) in 1870, where in an individual named Robinson was charged with the murder of his mistress. Though there appeared to be a match between bite marks on the victim's arms and his teeth, Robinson was acquitted of the charge.³ In 1906, two colliers were charged with breaking and entering into a store followed by theft of some goods, during examination of the premises, a block of cheese was discovered from which a piece had been bitten out leaving teeth marks. Bite mark analysis and comparison led to his conviction. In 1949, a bite mark was discovered on the breast of a female murder victim in Tunbridge Wells. The husband was convicted of this act when models of his irregular teeth corresponded with the bite mark on the victim.⁴

However, the first case establishing the legal admissibility of bite mark evidence was Doyle vs. State of Texas in 1954. This case also involved bite marks left in some cheese at crime scene. The defendant, Doyle, was asked to bite an

another piece of cheese and a comparison was made. The evidence was considered admissible and in fact it was the court's opinion that it was almost as convincing as finger print evidence.⁵

Sorup used transparent paper representations of a suspect's dentition and compared them with a life size bite mark photograph in 1924.⁶ Keiser-Neilsen in 1975 put forth a theory of probability for duplication of human dentition.⁷ Sagnnaes et al (1982) evaluated bite marks obtained from identical twins and demonstrated significant variations.⁸ Rawson et al (1984) established the scientific basis for statistical analysis as the uniqueness of human dentition.⁹ Aboshl et al (1994) describes a case of arson in which the suspect was identified by comparing computer generated images of biting surfaces of the victim's cast with that of food stuff obtained from the crime scene.¹⁰

Drummond and McKay (1999) have reported a case of bite mark analysis done on an amputated forefinger (due to biting).¹¹ McKenna et al (2000) have recounted a case of bite marks on chocolate that were analysed and led to the conviction of chocolate thieves!¹² A similar case involved the study of white marks left in the cheese at murder scene.¹³ In the current study identification of an individual was done through bite mark, by different technique using transparent overlays from study dental cast models and life size photograph of bite marks in different materials like clay and cheese.

MATERIAL AND METHOD

One hundred and three students of medical college were taken, age 18–28 years (M : F 53 : 50) and a serial number was allotted to each volunteer. Bite marks were taken on two

groups of items.

- Perishable substance like cheese which may be usually found at crime scene.¹⁴
- Non-perishable substance like clay which is flexible synthetic material, which reproduces marks well and dimensionally stable.¹⁵

The volunteers were divided into two groups of 51 and 52 and each group took bites on clay and cheese. For identification, standard method of different technique by transparent overlays from study dental cast model and life size photography of bite marks was used. The present study was performed in two parts.

- A collection of bite marks of volunteers in different material by photograph
- Comparison of bite marks with dental cast of the same volunteer biter by comparison method.

The process involved production of bite marks by volunteers by biting marks were taken and dental model cast from bites teeth was made. Then comparison was done.

A digital camera was used for photography and photo were transferred to a computer for printing and analysis. Photography was done vertically so that the chances of distortion of photograph were reduced to minimum. A scale was also kept, as it served dual purpose, firstly obtaining relative size and secondly allowed accurate enlargement. A scale with certified accuracy should be used and the same scale should be used through out the whole photographic process.¹⁴

Impressions of both arch were taken with a Alginate (Densply) in a dental tray (Ash), which gave negative replica of teeth, which set in 45 second, then positive replica, a model was obtained with dental stone-IV, which sets 13 minutes. The model casts were evaluated for dentition and impression. The size of arch, abnormal position of teeth, wear and tear, rotation teeth were looked for. A sheet of transparency film and fine tipped felt pen (Add gel) was used to mark the perimeter of the biting surface of each teeth, by hand tracing.¹⁶

DIRECT COMPARISON

In this method model was placed directly over photography and concordant point demonstrated. Hence, the model was

moved on the photograph.¹⁷

INDIRECT COMPARISON

In this method, transparent overlay was placed directly over the bite marks on photographs and the match was noted.¹⁸

OVERALL ANALYSIS

To identify the characteristics of bite marks, comparison of dental cast with photograph and to give expert comments, is the match was positive or else.¹⁹

MATCH POSITIVE

There were no doubts about the bite marks when compared with dental costs it was termed as match positive.¹⁹

MATCH NON-CONTRIBUTORY

In case the dental cast did not match at all with photograph of bite marks or there was some degree of doubt due to technical fault in making of cast or photograph, then the comment of expert was reserved as match non-contributory rather than match negative.¹⁹

RESULTS

Bite marks on the clay, the match was positive in 95 per cent while it was positive in 81 per cent in cheese. In comparing the direct and indirect method of match, it was found that when the comparison by indirect comparison method remains inconclusive, the direct comparison method tends to match.

Figure 1

Table 1: Bite Marks Matches

Sr. No.	Bite Marks on	No. of cases	Direct	Indirect	Positive	Non-contributory
1.	Clay	51	48	48	48	5% (3)
2.	Cheese	52	42	42	42	19% (10)

Figure 2

Table 2: The Factors Of Non-Contributory Match

Sr. No.	Cause	Proper	Non Contributory	Total
1.	Photographs	97	6	103
2.	Models	96	7	103

DISCUSSION

In 1971, De vore 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. He concluded that there is a

large margin of error in using bite marks photographs and unsecured excised skin.²⁰

Mckenna et al (1999) reported a case in which the assailant was identified by comparing the bite marks inflicted on the avulsed portion of the victims ear with the translucent acrylic replica made from the assailant dental impression.²¹

For effective study, analysis of a bite injury must be done as early as possible, as the clarity and shape of the mark may change rapidly in both living and dead victims since a large proportion of individuals (about 80%). Secrete AB blood group in their saliva, swabbing the bite site is an essential prerequisite. The swab (together with a control swab from elsewhere on body) should be moistened with sterile distilled water, airdried, and submitted to a serological or forensic laboratory.²² Some investigators have suggested using fingerprint “dusting” methods for bite mark analysis. Some authors have recommended that in addition to customary colour and B & W films, ultraviolet photography should be undertaken.²³ The technique consists of irradiating the bite mark with UV light source and exposing a B & W film through a UVA filter.²⁴ To preserve the three-dimensional nature of a bite mark, impressions can be taken utilising standard dental impression material which is then poured in dental stone to produce models.²⁵ When a suspect is identified, impression can be made in the usual manner to produce dental models, and in addition intraoral photographs and bite impressions can be taken. Analysis of bite marks has been standardised by the American Board of forensic odontology²⁶ though not been universally accepted. Further analysis of bite marks is done by superimposition of marked transparency of inked edges of the plaster model of teeth over the bite mark.²⁷ While in present study comparison methods is used. Bite mark in clay, the match was positive in 95% cases, while it was positive 81% in cheese. The match was non-contributory due to defective model cast in 6% cases and due to detective photography in 5% cases. In comparing direct and indirect method of match, it was found that when the comparison by indirect comparison method remains in conclusive, the direct comparison method tends to match.

Of late there has been an effort to improve the analysis and interpretation of bite marks using sophisticated method. Such as scanning electron microscopy and computerised image enhancement.^{29, 30}

CONCLUSION

Bite mark in clay, the match was positive in 95% cases, while it was positive 81% in cheese. The match was non-contributory due to defective model cast in 6% cases and due to detective photography in 5% cases. In comparing direct and indirect method of match, it was found that when the comparison by indirect comparison method remains in conclusive, the direct comparison method tends to match.

ACKNOWLEDGEMENT

Authors are thankful to Dr. Simmi Kharb for review the manuscript.

CORRESPONDENCE TO

Balwant Rai S.Sct.
S/o Sh. Ram Swaroop
Village Bhangu,
District Sirsa,
Post Office Sahuwala First
Haryana (INDIA)
Mobile 0091-9812185855

References

1. Danielson K. Guest editorial. *Int J Forensic Dent*, 1978; 1 : 1-2.
2. Swanson HA. *Forensic Dentistry*. *J Am Coll Dent*, 1967; 34 : 175.
3. Pierce LJ : The case of Ohio vs. Robinson : An 1870 bite mark case. *Am J Forensic Med Pathol*, 1996; 11 : 171-77.
4. Tedeschi CG, Eckert WG, Tedeschi LG : *Forensic Odontology*, In : *Forensic Medicine*. Vol. II *Physical Trauma* : WB Saunders Company, Philadelphia 1973 : 1116-1153.
5. Rothwell BR. *Bitemarks in forensic dentistry : A review of legal and scientific issues*. *J Am Dent Assoc*. 1995 (126) : 223-232.
6. Strom F : *Investigations of bite marks*. *J Dent Res* 1963 (42) 312.
7. Keiser - Nielsen S : *Probability*. Paper presented at 2nd Annual Conference of Forensic Odontology. San Francisco, USA (1975).
8. Sagnaes RF, Rawson RD, Graft BM, Nguyen NBT : *Computer comparison of bite mark patterns in identical twins*. *J Amer Dent Assoc*. 1982 (105) 449-452.
9. Rawson RD, Ommen RK, Kinard G et al. *Statistical evidence for the individuality of the human dentition*. *J Forensic Sci*, 1984 (29) : 243-253.
10. Aboshi H, Taylor JA, Takei T, Brown KA : *Comparison of bite marks in food stuff by computer imaging : A case report*. *J Forensic Odontostomatol* 12 : 41-44.
11. Drummand JR, Mckey GS : *Biting off more than you can chew : A forensic case report* : *Br Dent J*, 1999; 187 : 466.
12. McKenna CJ, Haron MI, Brown KA, Jones AJ : *Bite marks in chocolate : A case report* : *J Forensic Odontostomatol*, 2000; 18 : 4-10.
13. Bernitz H, Piper SE, Solheim T, et al. *Comparison of bite marks left in food stuffs with models of the suspect's dentitions as a mean of identifying a perpetrator*. *J Forensic Odontostomatol* 2000; 18: 27-31.
14. Clark DH : *Bite marks in tissue and in inanimate objects*

: analysis and comparison. Practical forensic odontology. Wright 3rd Ed. 1980 : 107, 128-129, 149, 152-153, 159.

15. Jonason CO, Frykholm KO and Frykholm A. Three dimensional measurement of tooth impression of criminological investigation of tooth in soap. Br Dent J 1984; 157 : 270-1.
16. Sweet D and Bowers M. Accuracy of bite marks overlays. Paper presented at the meeting of American Academy of Forensic Sciences, Odontology Section, New York. 21 Feb. 1997.
17. Farness J. A new method for the identification of teeth marks in cases of assault and homicide. Br Dent J, 1968; 124 : 2161-6.
18. Morgn H. Zat Frage der Bisspureh. Rdsch 1943 (52) 791-6.
19. Gorea RK et al. Marvelous tools of identification - Bite marks : Medico-legal Update (April-June) 2005; Vol 5 (2).
20. DeVore DT. Bite marks for identification. Med Sci Law 1971, 11 (3); 144-5.
21. McKenna CJ, Haron MI, Taylor JA. Evaluation of a bite

mask using clear acrylic replicas of the suspect's dentition : A case report. J Forensic Odontostomatol 1999 (17) 40-43.

22. Johnson LT, Cadle D : Bitemark evidence recognition, preservation, analysis and courtroom presentation NY State Dent J 1989 (55) 38-41.
23. Krauss TC. Forensic evidence documentation using reflective ultraviolet photography. Photo electronic imaging : 1985 (12) 18-23.
24. Barsley RE, West MH, Fair JA. Forensic photography : Ultraviolet imaging of wounds on skin. Am J Forensic Med Pathol, 1990; (11) 300-308.
25. Benson BW, Cottone JA, Bomberg TJ, Sperber ND. Bite mark impressions : A review of technique and materials : J forensic Sci 1988; 33 : 1238 - 1243.
26. American Board of Forensic odontology : Guidelines for bite mark analysis. J Amer Dent Assoc, 1986; 112 : 383-386.
27. Humble BE. Identification by mean of teeth : British Dent J 1933; (54) 528.

Author Information

Balwant Rai, S.Sct.

Intern, Govt. Dental College, PGIMS

S. C. Anand

Principal, Govt. Dental College, PGIMS

Manish Madan

Lecturer, Govt. Dental College, PGIMS

S. K. Dhattarwal

Associate Professor, Dept. of Forensic Medicine, PGIMS