

BITE MARKS : THE ODONTOLOGIC METAPHOR FOR FINGER PRINTS

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Abstract

Bite mark can be considered as an important alternative for fingerprints and DNA examination in forensic investigations. Bite marks can be recorded in various serious crimes and its analysis can play a major role in personal identification in forensic odontology. Bite mark analysis is an important process which requires further research to evaluate new techniques in this field. This article aims at providing a complete review on bite marks.

Keywords: Forensic odontology, bite marks, teeth

INTRODUCTION

Forensic odontology plays a major role in identification of people injured in various mass disasters such as earthquakes, tsunamis, aviation accidents as well as in investigations and identification of decomposed and disfigured bodies¹.

Just like fingers, no two mouths or two teeth are exactly identical². Each and every dentition, position of the teeth as well as the occlusion are unique for every individual. So, it can permit precise identification because the alignment of teeth is peculiar to each individual and this makes forensic odontology play an important role in the identification of either alive or deceased³.

Mc Donald in 1972 defined bite marks as "A mark made by the teeth either alone or in combination with other mouth parts". Beckstead in 1979 defined it as "The registration of tooth cutting edges on a substance caused by jaw closure." Bernstein ML in 2004 defined bite marks as "Patterns made by teeth in skin, food, or firm but compressible substrates"².

The nature of the contact between the mouth parts and the bitten material influences the resultant bite mark⁴. Bite marks may be caused by humans or animals. Biting is considered to be a primitive type of assault and results when teeth are employed as a weapon in an act of dominance or desperation. As a result, bite marks are usually associated with crimes. The use of bite marks has played a key role in various investigations to prove the contact between suspect and victim⁵.

Bite marks may be found on diverse materials in a crime scene, but the most common and unfortunate site is human skin¹. Human bite marks can be described as an elliptical or circular injury which is composed of two U- shaped arches, separated at their bases by an open space and that records all the specific characteristics of the teeth. Human bites may be found on any part of the human body, commonly seen on face with a frequency second to that of upper extremity. On face, bite marks are usually seen on ears, nose and lips. In case of violent assaults where there are more than one bite, it is usually difficult to identify the bites.

Some of the common forms of injuries that are observed along with the bite marks include lacerations, abrasions, contusions, petechiae, indentations, erythema and punctures⁶.

History:

The field of forensic odontology may seem to be a new one, but it might be old and prevailing since the existence of Human kind. This is also supported by holy book Bible which says "Eve persuaded Adam to put a bite mark in an apple³."

A term "Salem Witch Trial" was used for the first ever incident of bite mark identification which occurred in 1692. The first case which was solved using bite mark registration was a robbery case in America in which a piece of cheese registered with a bite mark was found in the crime scene and that played a role in solving the case by revealing the thief's identity. Another case involving serial killer Theodore (Ted) Bundy, was a highly publicized case which paved a path for the acceptance of bite mark as a evidence in courts. In this case, the suspect was convicted based on bite mark analysis by the US judicial system³.

Uniqueness of human dentition:

Bite marks play an important role in forensic examinations besides fingerprints and DNA identification. Every human dentition has its own uniqueness. Analysis of bite marks is based on the principle of "No two mouths are alike"⁷.

Specific characteristics of teeth such as teeth arrangement, fractures, attritional wear, rotations and congenital malformations aids to the uniqueness of human dentition⁶.

Classification of bite marks:

1. Cameron and Sims' classification

A relatively simple, wide- encompassing classification, based on the type of agent producing the bite mark and the material exhibiting it.

1) Agents

- Human
- Animal

2) Materials

- Skin, body tissue
- Foodstuff
- Other materials

2. Mc Donald's classification in 1979³

Probably the most cited, Mc Donald suggested an etiologic classification. This is pertinent for human bite marks, but Mc Donald adds, 'it is equally applicable to marks on other materials'.

1) Tooth pressure marks

Marks produced on tissue as a result of 'direct application' of pressure by teeth. These are generally produced by the incisal edge or occlusal surfaces of teeth.

2) Tongue pressure marks

When sufficient amount of tissue is taken into the mouth, the tongue presses it against rigid areas such as the lingual surface of teeth and palatal rugae. The marks thus left on the skin are referred to as 'suckling', since there is a combination of sucking and tongue thrusting involved.

3) Tooth scrape marks

These are marks caused due to scraping of teeth across the bitten material. They are actually caused by anterior teeth and present as scratches or superficial abrasions.

4) Complex marks

Combination of above

3. Webster's classification³

It is not uncommon to note bite marks on foodstuff. This is especially so in cases of theft or robbery at residences where the thief may bite on food items during the course of crime.

1) Type I - The food item fractures readily with limited depth of tooth penetration (eg. Hard chocolate).

2) Type II- Fracture of fragment of food item with considerable penetration of teeth. (eg. Bite marks in apple and other firm fruits)

3) Type III- Complete or near complete penetration of the food item with slide marks (eg. Cheese, banana)

4. Clinical classification (Gustafson in 1996)⁸

1) Sadistic or sexual bite

2) Aggressive bite

3) Most aggressive bite involves ears, nose and nipples.

5. By degree of impression (Shashikala K in 2003)⁹

1) Haemorrhage- a small bleeding spot

2) Abrasion- undamaging mark on skin

3) Contusion- ruptured blood vessels, bruise

4) Laceration- near puncture of skin

5) Incision- neat punctured or torn skin

6) Avulsion- removal of skin

7) Artifact- bitten- off piece of body

6. Agents producing marks¹⁰

1) Humans- adults, children

2) Animals- mammals, reptiles, fish

3) Mechanical- dentures, saw blades

7. Materials in which bite marks are produced¹⁰

1) Skin and bony tissues

2) Food substances

3) Materials chewed habitually eg. Pipe stems, pens and pencils

8. Definition of bite mark (Shashikala K in 2003)⁹

1) Clearly defined- that results from the application of significant pressure.

2) Obviously defined- effect of first degree pressure

3) Quite noticeable- due to violent pressure

4) Lacerated- when the skin is violently torn from the body.

9. Other classification¹⁰

1) Sexually oriented bites

2) Child abuse cases

3) Self- inflicted marks

10. Classes that are of proven significance in practical application regarding bite marks are:⁷

- 1) Class I- It includes diffused bite marks which is having limited class characteristics and lacks individual characteristics. Such as bruise, diffused bite mark, a smoking ring or, a faint bite mark.
- 2) Class II- This pattern of injury referred to as a single arch bite or the partial bite mark as it has some individual and some class characteristics.
- 3) Class III- This classification includes both individual as well as class characteristics. This bite has great evidentiary value and used mostly for the comparison purposes. The main sites for this type of bite on the body are buttocks, shoulder, an upper arm or the chest. The pressure and deep penetration of tissues is held to record the lingual surface of anterior teeth.
- 4) Class IV- Mainly, avulsion or laceration of the tissues is caused by the bite. In this class, class characteristics and individual characteristics are not present. This type of bite is commonly found where there is avulsion of an ear or finger.

Mechanism of bite marks:

Bite marks are produced mainly by three mechanisms- tongue pressure, tooth pressure and tooth scrape. Tongue pressure is formed when any material placed into the mouth is either pressed by tongue against teeth or pressed by tongue against palatal rugae. Tooth pressure marks are formed by application of direct pressure by incisal edges or occlusal edges of teeth. Tooth scrape is formed when teeth is scraped against tooth surface usually involving the anterior teeth⁷.

Appearance of bite marks:

Human bite marks may be found on all parts of the body, on the skin of the victims. It may be described as a circular or elliptical injury which records all the possible characteristics of dentition. Human bite mark may also be composed of two U- shaped arches, representing the maxilla and mandible and that may be separated by an open space, at their bases².

When teeth of only one arch either maxilla or mandible comes in contact with the skin, C- shaped mark is produced, instead of U- shaped mark⁷.

The range of the injury of bite mark is 25- 40 mm diameter. It occurs due to pressure of the biting teeth and the negative pressure created by tongue as well as the suction effects. This leads to extra-vascular bleeding and thereby bruising. Colour changes of the bruising may be seen over a period of time due to the healing process undergoing in the skin of the living⁷.

Mandibular teeth are more commonly detected in bite marks as compared to maxillary teeth because of the lower jaw movement during the process³.

Location of bite marks:

The anatomical location of bite marks plays an important role for the determination of its potential. Females are said to be bitten more commonly as compared to males. Bite marks can be both- an attack injury, present on the victim as well as a defensive wound, present on the suspect¹¹.

In sexually motivated attack, bite marks are usually seen on the neck, breasts and shoulders. Bites of the arms and the buttocks are commonly seen in child abuse cases. Non- sexual bite marks are seen on arms, legs, fingers, hands, chest and ears¹².

Recording of bite marks:

Bite marks should be recorded before removing the dead body from the crime scene to avoid any kind of compromise with the accuracy of the evidence. Bite marks from the foodstuffs should be recorded as quickly as possible to minimize the distortion by the loss of moisture and inappropriate temperature. Bruises have a tendency to change its colour and lessen the mark or impression over a period of time in the living subject¹².

Collection of evidence:

For investigation of the injury, it is essential to collect the evidence associated with bite marks. Collection of bite mark evidence includes various methods such as photography, impressions of bite injury, saliva swabs, excision of bite marks for transillumination in the deceased victim, test bites, etc². Collection of evidence is done from the victim as well as from the suspect.

1. Photography

It is considered to be the standard protocol for evidence collection. It includes both color and black and white photographs. Location photograph should be taken to know the exact location where the mark is formed in the body³.

2. Digital photography

Digital cameras are used to capture the image which are later on transferred to computer for processing and printing. DIMS is an image software commonly used for this³.

3. Swabs

Swabbing of the bite mark or bite injury is done in order to recover the trace evidence. 0.3 ml of saliva is estimated to be deposited during the biting process and it spreads upto 20 cm². Double swab method is also used where first of all a swab moistened with distilled water is made to run over the surface. Then a dry swab is used to absorb the extra moisture which later on is air dried³.

4. Bite print recording

In this method, fingerprint lifting powder is used for brushing onto the bite mark. Later fingerprint lifting tape is used to record the bite mark³.

5. Tissue samples

It is usually done in deceased victims where the entire area of bite mark is excised with proper anatomic condition. After excision, the tissue can be transilluminated with the help of shining light from dermal side or inner aspect of tissue. This is done to enhance and improve the view of bleeding patterns caused by teeth³.

Methods of bite mark analysis:

Bite mark analysis is done to identify the perpetrator. It is used to match the bite mark found on the victim with the dentition of the suspect⁷.

Visualization and comparison, formation of the opinion and court testimony are involved in analysis of bite marks².

Bite marks analysis is done by direct and

indirect methods. Direct method includes metric analysis. Indirect method includes transparent overlays, Photocopier method by Dailey, Photographic overlays, Overlays using radiographic films, Computer based overlays².

Difficulties in bite mark analysis:

- Distortion due to skin elasticity.
- Loss of data
- Contamination
- Subjective element in comparison
- Subjective element in fabrication.¹²

Clinical significance of bite marks:

Bite marks plays a significant role in investigations in the field of forensic dentistry. Human bite marks are seen in most of the serious crime including sexual assaults where the bite marks are seen on the victim as well as on the suspect. Bite marks found on the victim may be a result of violent attack while that found on the suspect may be a result of self- defense by the victim. Bite mark helps to solve these cases as human dentition is unique and no two teeth are similar. On the other hand, bite mark also proves to be helpful in solving many cases of theft and robbery where bite marks may be found on the foodstuffs located near the crime scene, whose analysis may help to find the guilty¹³.

Legal aspects of bite marks:

Formation of bite marks is usually seen in various violent crimes such as sexual assaults, homicides, child abuses, etc. As this field is expanding in forensic investigations nowadays, bite mark analysis is conducted as a part of various medico- legal cases and procedures. This includes objective documentation and then interpretation of the bite mark as an evidence. Bite mark analysis may yield some valuable information that forensic odontologists

testify to in the courts of law and thereby may help to find out the perpetrator. In bite mark cases, a forensic odontologist's work is of great importance and proper analysis may prove to be a turning point in the conviction of the suspect¹⁴.

CONCLUSION

Bite marks can be used as an effective aid for investigation in forensic dentistry. Bite marks if analysed properly can play an important role in solving various crime including bite marks as evidence, by identifying the person involved in the crime. Forensic field involving bite marks is expanding with time. So, it is essential for us to increase our knowledge regarding this field and further research should be carried out to find out new techniques for bite mark analysis.

REFERENCES

1. Bhagat S, Gupta V, Tyagi N, Sharma E, Gupta S, Dadu M. Berry's index: Adjuvant to bite marks. *J Forensic Dent Sci* 2018;10:45-9.
2. Shazia Shafat Shah, Bite marks: A potent tool in forensic dentistry: A review, *International Journal of Medical and Health Research*, ISSN: 2454-9142, Impact Factor: RJIF 5.54, Volume 3; Issue 3; March 2017; Page No. 21-23
3. Rao DS, Ali IM, Annigeri RG. Bitemarks - A review. *J Dent Res Rev* 2016;3:31-5.
4. Seasby, D.G. MacDonald, A forensic classification of distortion in human bite marks, *Forensic Science International* 122(2001)75-78
5. IA Pretty, D Sweet, The scientific basis for human bitemark analyses- a critical review, *Science & Justice* 2001; 41(2): 85-92
6. Padmakumar SK, Beena VT, Salmanulfaris N, Acharya AB, Indu G, Kumar SJ. Bite Mark Analysis. *Oral Maxillofac Pathol J* 2014;5(2):488-490
7. Kaur S, Krishan K, Chatterjee PM, Kanchan T (2013) Analysis and Identification of Bite Marks in Forensic Casework. *Oral Health Dent Manag* 12: 500. doi: 10.4172/2247-2452.1000500
8. Gorea RK, Jha M, Jasuja OP, Vasudeva K, Aggarwal AD. Marvelous tool of identification-Bite mark. *Medico-legal update*. 2009; 5(2):33-39.
9. Sunil MK, Kumar R, Guru EN, Mehta T. Bite marks-A review. *BFUDJ*. 2010; 1(2):45-50.
10. Masthan KMK. *Textbook of Forensic Odontology*, New Delhi: Jitendar P Vij, 2009.
11. Iain A Pretty, *Forensic Dentistry: 2. Bitemarks and Bite Injuries*, *Dent Update* 2008; 35: 48-61
12. S. Swetha, Dhanraj Ganapathy, Bite mark analysis - A review, *Drug Invention Today*, Vol 11, Issue 3, 2019

13. Verma K, Joshi B, Joshi CH, Rejz Paul MP (2013) Bite Marks as Physical Evidence from the Crime Scene-An Overview. 2:605 doi:10.4172/scientificreports.605

14. Arthanari A, Doggalli N, Patil K, Jai Shankar HP, Vidhya A. Bite mark: Is it still valid??. Int J Forensic Odontol 2019;4:14-20

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How to cite this article: Khan T, Sunil M K, Yeluri G, Srivastava S, Srivastava M, Mehfooz A Bite marks : the odontologic metaphor for finger prints. TMU J Dent. 2020;7(1):22-26.