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Review Research Paper

Bite Marks: An Indispensible Forensic Odontological Evidence in Rape Cases

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Abstract

Forensic odontology has gained wide acceptance in the field of criminal justice because no two people have identical teeth. **Presence of physical evidence such as** bite-marks in cases of rape, murder and violence are considered very valuable. These are considered to be an expression of dominance, rage and animalistic behavior. Bite-marks are the commonest form of dental evidence presented in criminal court in rape cases. These marks are also valuable in determining the type of physical abuse and age bracket of the criminal. To deal with bite-mark evidence a Forensic dentist is called. Exclusion of a suspect in rape cases based on the specific tooth patterns and opening range is also possible. With increase in criminal cases like rapes the use of bite-marks as Forensic odontological evidence in nailing the culprits truly points out the important role odontology plays in field of criminal justice. This review highlights the importance of bite-marks as indispensible Forensic odontological evidence in rape cases.

Key Words: Forensic odontology, Bite marks, Rape, Identification, Crime

Introduction:

Forensic **Odontology** is a branch of forensic medicine that in the interest of justice deals with dental evidence presented in the courts of law. [1] The basis that Forensic odontology has gained wide acceptance in the field of criminal justice is because no two people have identical teeth. [2]

A Forensic Odontologist is involved in the analysis of bite marks on victims and presentation of bite mark evidence in court as an expert witness. As no two fingerprints are alike, neither are two bite-marks. [3]

Bite-marks form crucial evidence in case of violent rapes against women which is considered a heinous crime. These marks are seen when teeth are used as weapons of anger, excitement and destruction. During struggles between assailants and victims, mostly skin of victims bear bite marks. The specific pattern of marks on victim's body gives a clue about the type of abuse.

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The age bracket of the criminal can also be analyzed through these marks. Bite marks can also exclude a suspect on basis of tooth pattern and opening range. [4]

During sexual attacks including sexual homicide, rape and child sexual abuse, bite marks are clustered around parts of body associated with sexuality. Females are usually bitten on the breasts, nipples, abdomen, thighs, buttocks and pubis, while men are usually bitten on the back, arms, shoulders, chest and penis. [5]In cases of homosexual assault in male victims bite-marks are found on the back of the shoulder, arm or armpit, chest and penis. In cases of self-defense the victim can bite on the hands and arms of an assailant. [6]

Definition:

ABFO defines bite-marks as "a pattern left in an object or tissue by the dental structures of an animal or human," [3] whereas Mac Donald described it as a mark caused by the teeth either alone or in combination with other mouth parts. [2] The size, shape and pattern of the biting edges of the anterior teeth in the upper and lower dental arches are considered to be specific to an individual.

Hence a bite mark shows unique pattern of an individual's teeth**,** also it can help in excluding suspects to whom the mark does not belong to. [2]

Historical Review:

Bite mark evidence has slowly gained acceptance as a Forensic tool. The earliest recorded bite mark case in the United States was Ohio vs. Robinson in 1870. Ansil Robinson was suspected of murdering his mistress, Mary Lunsford. His teeth matched to bite marks on the victim's arm, but Robinson was acquitted. [7]

The most famous bite mark case was of Ted Bundy (raped and killed more than 30 women) who was convicted of rape and murder of Lisa Levy and Martha Bowman. He had left a bite mark on Lisa levy's buttock.

While investigation, the mark was photographed with a ruler kept alongside.

Bundy's teeth were photographed, the bite mark was matched against his teeth and he was convicted. This case also highlighted the importance of photographing the bite-mark with a ruler at the scene, as the bite-mark may degrade with time but the photograph may reveal the original size and shape of mark which can be used for comparison with transparent overlay of victim's teeth in future. [8]

Many other rapists and serial killers have been convicted based on bite mark testimony over the years. [9]

Classification of Bite Marks:

A. Cameron And SIMS Classification:

This is based on the type of agent producing the bite mark and material exhibiting it.

1. **Agents:**
   a) Human
   b) Animal
2. **Materials:**
   a) Skin, body tissue
   b) Food stuff
   c) Other materials

B. Mac Donald's Classification:

a) Tooth Pressure Marks: Marks produced on tissues as a result of direct application of pressure by teeth. These are generally produced by the incisal or occlusal surfaces of teeth.

b) Tongue Pressure Marks: When sufficient amount of tissue is taken into mouth, the tongue presses it against rigid areas.

c) Tooth Scrape Marks: These are caused due to scraping of teeth across the bitten material. They are usually caused by anterior teeth and present as scratches or superficial abrasions. [2]

C. According To Degree of Impression:

a) **Clearly Defined** - significant pressure
b) **Obviously Defined** - first degree pressure
c) **Quite Noticeable** - violent pressure
d) **Lacerated** - skin violently torn from body. [10]

The severity of the injury gives indications of the mental state of the offender. Accordingly there may be presence of hemorrhage, abrasion, contusion, laceration, avulsion or artefact.

Location:

A study done to evaluate the anatomical location of bite-marks in 101 cases from United States courts of appeal found that human bite-marks can be found at almost every anatomical location, with a bias towards certain areas.

The crime type, age and sex of the subject affect anatomical location of a bite injury. Biting is seen in crimes like homicide, rape, sexual assault, robbery and child abuse.

The study also revealed that females are four times more likely to be bitten than males, and the bites are concentrated on the breasts, arms, and legs. In case of female children bite marks are seen on the face, legs, and arms. Males are most frequently bitten on the arms, back, and hands. Also more than one bite-mark in a different anatomical location from the first can be found in a victim. [11]

Factors Affecting Bite Marks in Skin:

1. The size and shape of bite-mark is affected by its location on the body, because certain areas of the body bend distorting the surface area of the skin due to high viscoelasticity.
2. Some marks are made through clothing. Hence clothing is considered a potential source of bite mark impressions and biological evidence from transferred saliva.
3. Loose skin/subcutaneous fat lead to a poor bite mark. Whereas areas of fibrous tissue or high muscle content bruise less easily and demonstrate good bite mark. Infants, elderly and females tend to bruise more easily. [5, 12]

Mechanism of Bite Marks:

A bite mark occurs mainly due to pressure of teeth on skin. It is accompanied by mandibular closure and suction of skin (as a negative pressure).

Upper jaw is usually stationery and holds and stretches the skin and lower jaw is moveable and gives the most biting force. A human bite mark is an elliptical or circular injury with specific characteristics of the teeth.

If there is a single "C" shaped mark, then only one jaw (lower jaw) was involved. The diameter of injury ranges from 25-40 mm.

Bruising within the marks is caused by pressure from the teeth as they compress the tissue inward. [13]

Physical Characteristics of a Bite Mark Pattern:

The amount and degree of detail recorded in the bitten surface varies from case to case. First it is important to determine which teeth made the marks. The term 'characteristic', is a distinguishing feature, trait, or pattern within the mark. It is of two types, class characteristic & individual characteristic.

Class characteristic is a feature, pattern, or trait which reflects a given group and is not related to a particular individual. The biting surfaces of teeth are related to their function like incising, tearing or grinding. Front teeth are the primary biting teeth in bite marks.

The two upper central incisors are wide, lateral incisors are narrower and cuspids are cone shaped. The two lower centrals and two laterals are uniform in width and lower cuspids are cone shaped. The upper jaw is wider than the lower jaw. The characteristics of individual teeth are

1) **Incisors:** Rectangular shaped mark, sometimes with perforations at the incisal angle areas
2) **Canines:** Triangular markings with apex towards labial and base towards lingual
3) **Premolars:** Single or dual triangle with bases of triangles facing each other or coming together as diamond shaped
4) **Molars:** Rarely leave bite marks, usually quadrilateral markings. [14]

An individual characteristic is a feature, pattern, or trait that represents a variation from the expected finding in a given group, like a rotated, damaged, or broken tooth that differentiates two different dentitions and is helpful in determining the dentition that caused the bite injury or mark.

Cases with class characteristics are used to confirm the events of a crime & those with individual characteristics can identify an individual source. [15]

Thus depending on the characteristics it is possible to use terms like "unique", "possible bite mark", "definite bite mark", "positive match", "consistent with" and "probable biter".

For a positive identification to be made there must be marks left by four or five approximate teeth. [16]

Types of Distortions:

Two associated terms are primary and secondary distortion. Primary distortion depends on dynamics of the bite. Secondary distortion is of three types: time related distortion, posture distortion, and photographic distortion. The longer the time interval after the mark is made, the less distinct the mark will be in both living and dead. In the living, bruising occurs. In the dead, the body begins to decompose and shrinkage by rigor mortis occurs. [16, 17]

Bite Mark Analysis:

Any analysis involves two steps, first the discovery and preservation of evidence and second involves evaluation, comparison and findings of the recovered evidence.

In analyzing bite-marks, first it should be determined if the injury is a bite-mark and whether it is caused by human teeth. Consistency of marks with the time of the crime should be determined.

To standardize the analysis of bite marks the American Board of Forensic Odontology (ABFO) established the following guidelines in 1986:

1) **History**: Thorough history of any dental treatment carried out after the suspected date of the bite mark should be taken.
2) **Photography:** Extra oral photographs including full face and profile views, intraoral should include frontal views, two lateral views and an occlusal view of each arch, a photograph of maximal mouth opening.
3) **Extra-oral Examination:** Soft tissue and hard tissue factors that may influence biting dynamics. Measurements of maximal opening and any deviations on opening or closing should be noted
4) **Intraoral Examination**: Examination of tongue and periodontal status like mobility of teeth. In case of recent marks, they should be swabbed for DNA from saliva left in the wound.
5) **Impressions:** Two impressions of each arch using materials that meet the American Dental Association (ADA) specifications. The occlusal relationship should be recorded.
6) **Sample Bites**: Sample of suspects bite in centric occlusion using wafer of base plate wax or silicone putty material. The sample is photographed immediately & used for future comparison
7) **Study Casts**: are prepared using type II stone. [18, 19]

Collection of Bite Mark Evidence from Rape Victim:

In living and deceased victim the information to be collected from the bite mark is

- **Demographics**: Name, age, sex, race, case number, date of examination and name of the examiners should be recorded.
- **Location of the Bite Mark**: Describe the anatomic location, indicate the contour of the surface (flat, curved or irregular) and state of the tissue characters. Underlying tissue-bone, cartilage, muscle or fat
- **Shape of the Bite Marks**: whether it is round, ovoid, crescent or irregular in shape.
- **Colour and Size of the Mark**: Both vertical and horizontal dimensions should be recorded in metric system.
- **Type of Injury:** due to bite mark may be Petechial haemorrhages, Contusion, Abrasion, Laceration, Incision, Avulsion, Artefact etc.

Whether the surface of the skin is smooth or indented should be noted. [20]

Photographing the Bite Mark:

This is an important step during investigation as the photograph of bite-mark should be accurately produced. The use of digital camera instead of traditional allows the Odontologist to reduce the margin of error.

A life size dimension of the photograph is then recreated. If much time has lapsed after the mark was made then alternative photographic methods using ultraviolet light can be used to make images of the tips of the penetrated area. [8]

Comparison Techniques:

According to ABFO (1994) the most widely used methods for comparison of bite mark evidence are generation of overlays (acetate), test bite media e.g. wax exemplars, and Styrofoam. Recently software program Adobe Photoshop is being used to compare dental profiles. With its use transparent overlays can be created which are then laid over the bite marks.

The advantages of using computerized system are accurate measure of physical parameters of the evidence, less photographic distortion, eliminates any examiner subjectivity, good image visualization, standardization of comparison procedures and reproducibility of results. [21]

Problems in Bite Mark Analysis:

1) Doubts have been raised about the accuracy of the bite imprint as skin is considered a poor medium for accurate impressions due to curves and other irregularities producing intrinsic distortion.

Thus comparison of a person's teeth to bite-mark on a victim's body is prone to error leading to false implications of persons in crimes they did not commit.

2) Unlike fingerprints, which are stable over the course of an individual's life, the dentition is capable of major changes in configuration, with and without professional intervention.

Teeth lost due to extraction, trauma or exfoliation, changes in size and relationship of the arches due to growth or orthodontic procedures, alteration of biting surfaces by restorative materials, caries and changes in position of teeth due to periodontal disease.

3) The uniqueness of human dentition has not been definitely established. Also a bite mark is not an overall accurate representation of the teeth, tongue and jaw movements are also involved.
4) Questions about reliability of bite mark investigations arise due to different examiners arriving at opposite conclusions. Till date there is no standard comparison procedure for bite marks. Ultimate outcome depends on an examiner's objectivity and methods used. [22-24]

Conclusion:

The importance of bite marks providing valuable information in nailing a rape accused is based on the fact that the majority of rapists leave bite marks on their victims. Bite marks carry a high Forensic value based on the characteristics of the bite marks that are similar to the defendant's. Such evidence is as conclusive as DNA and fingerprint evidence in rape cases.

With technological advances and recent use of ultra violet lighting to detect human bite marks on rape victims **Odontology** has proved to be boon. To conclude it is rightly said 'while the criminal may lie through his teeth, his bite marks reveal all, and do not lie'.

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