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Bite marks: A potent tool in forensic dentistry: A review

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Abstract
In mortal combat situations such as the violence associated with life and death struggles between assailants and victims, the teeth are often used as a weapon. Indeed, using the teeth to inflict serious injury on an attacker may be the only available defensive method for a victim. Alternatively, it is well known that assailants in sexual attacks, including sexual homicide, rape and child sexual abuse, often bite their victims as an expression of dominance, rage and animalistic behavior. The teeth are a significant component of our natural arsenal. Bite marks have become one of the many different ways in which an assailant can be identified after an attack on another individual. The analysis of human bite marks is by far the most challenging and detailed part of forensic dentistry.

Keywords: assailant, sexual abuse, bite marks, forensic dentistry

Introduction

As no two fingers are identical, neither two mouths nor two teeth are exactly identical. 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" [1]. Bernstein ML in 2004 defined bite marks as "Patterns made by teeth in skin, food, or firm but compressible substrates" [2]. Bite marks can be found in cases of sexual violence in typical areas of the human body-genitals and breasts, but also in cases of child abuse. In such cases the number of the bites obtained can be very high. Aboshi *et al.* in 1994 reported the identification of a suspect arsonist by means of bite marks in cakes which were found at the crime scene. A missing upper right central incisor was proved to be in the patterned injury [3].

The establishment of a bite mark as an acceptable record of identification requires analysis of specific dental characteristics. The dental findings must include [4].

- Presence or absence of each tooth,
- Shape of each tooth,
- Relationship between upper and lower jaw,
- Arch form,
- Mesiodistal dimensions and
- Any unusual features (supernumerary teeth, rotation, fractured teeth, diastemas).

Fig 1: Bite marks

Classification of bite marks

1) Clinical classification (Gustafson in 1996) [5].
   - Sadistic or sexual bite
   - Aggressive bite
   - Most aggressive bite involves ears, nose and nipples
2) Etiological classification (Mc Donald in 1979) [5].
   - Tooth pressure marks
   - Tongue pressure marks
   - Tooth scrapes marks
   - Complex marks (combination of above)
3) By degree of impression (Shashikala K in 2003) [6].
   - Haemorrhage
   - Abrasion
   - Contusion
   - Laceration
   - Incision
   - Avulsion
   - Artifact
4) Agents producing marks [4].
   - Humans: adults, children
   - Animals: mammals, reptiles, fish
   - Mechanical: dentures, saw blades
5) Materials in which bite marks are produced [4].
   - Skin and body tissues
   - Food substances
   - Materials chewed habitually e.g. pipe stems, pens and pencils
6) Definition of bite mark (Shashikala K in 2003) [6].
   - Clearly defined
   - Obviously defined
   - Quite noticeable
   - Lacerated
7) Other classification [4].
   - Sexually oriented bites
   - Child abuse cases
   - Self-inflicted marks

Composition of bite mark

Bite mark evidence is compared with tool mark evidence when

attempting to show a narrowing of the focus from the big picture (i.e. a patterned injury is seen on the skin) to the smallest detail discovered (i.e. usual wear pattern or defect for an individual tooth observed in the injury). A characteristic, as applied to a human bite mark, is a distinguishing feature, trait or pattern within the bite mark and is delineated as a class or an individual characteristic.

a) Class characteristics

It is commonly referred to as the measurable features and shapes that allow the forensic dentist to ascertain an adult versus a child biter and to determine which teeth are present in the pattern. Examples are arch size differences that separate an adult from a child bite or maxillary from mandibular arch when both are present and discernible.[7]

b) Individual characteristics

These are deviations from standard class characteristics. Examples are a rotated tooth or a chipped tooth.[7]

Classic appearance of bite mark

Human bite marks are most often found on the skin of victims, and they may be found on almost all parts of the human body. A representative human bite is described as an elliptical or circular injury that records the specific characteristics of the teeth. The injury may be shaped like a doughnut with characteristics recorded around the perimeter of the mark. Alternatively, it may be composed of two U-shaped arches that are separated at their bases by an open space. The diameter of the injury typically ranges from 25-40 mm. often a central area of bruising can be seen within the marks from the teeth. Lacerations, petechiae, indentations, punctures, erythema and avulsions may be seen. Commonly, there is an area of ecchymosis contained within the defining shape of the bite mark.

Fig 2: Bite mark classic appearance

Collection of evidence

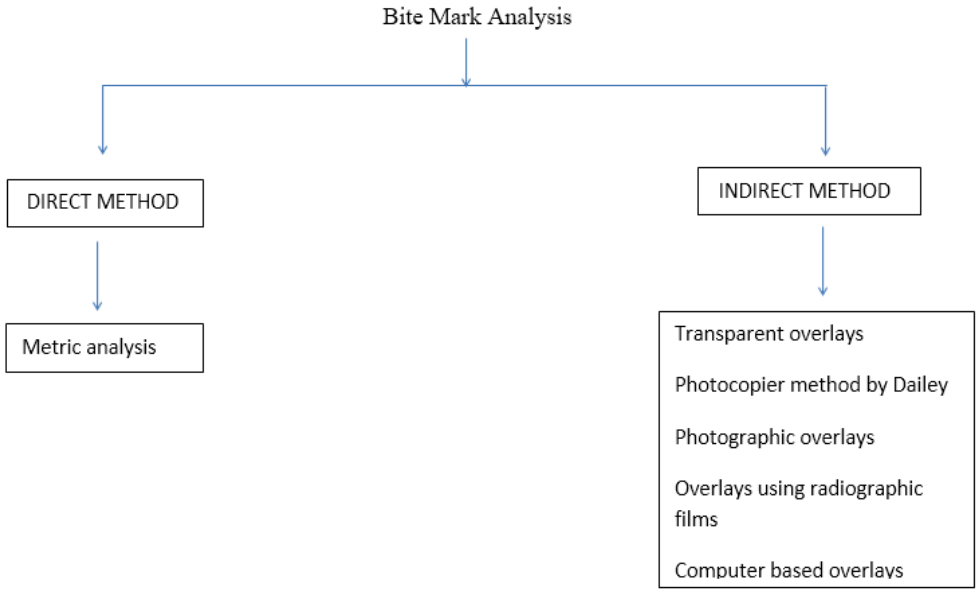
The collection of the evidence associated with bite mark is crucial for the forensic dentist to investigate the injury scientifically.

Collection of bite mark evidence includes the use of

- Photography
- Impressions of bite injury
- Saliva swabs
- Excision of bite mark for transillumination in the deceased victim
- Test bites

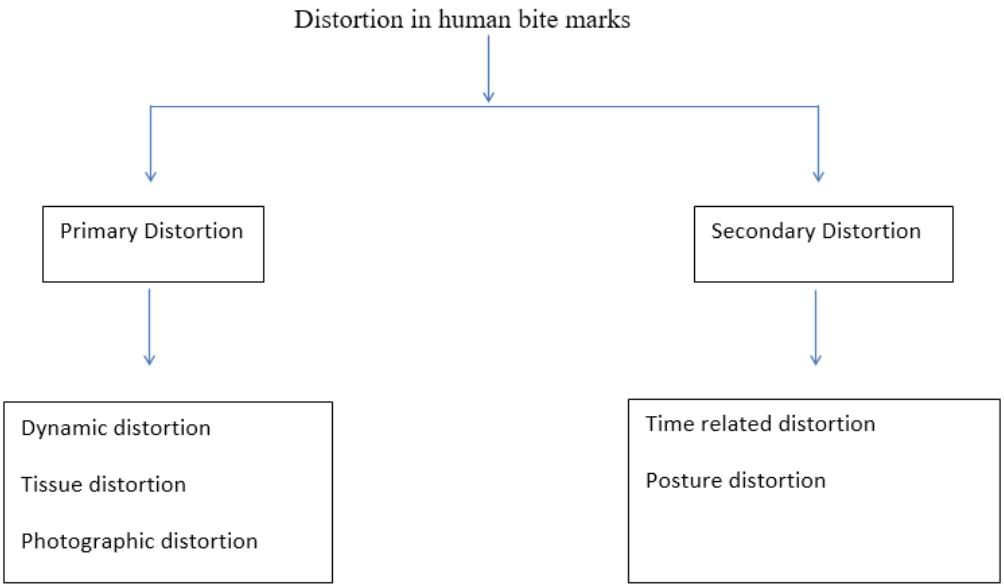
Bite Analysis

It is simply the comparison of bite mark evidence to suspect evidence to determine, if a correlation exists. Analysis involves visualization and comparison, formation of the opinion and often, court testimony.



Distortion in human bite marks

Distortion in bite mark may modify the appearance of a bite or the photographs of the bite, such that it is not an exact mirror image of the features of the mouth of the biter. Distortion can occur at different stages in the causation and the investigation of the bite marks. When it occurs at the time of biting it is called primary distortion. Distortion when occurs subsequent to the bite being made or introduced at the stage when the bite mark is being examined or introduced at the stage when the bite mark is being examined or recorded, it is called secondary distortion.



Bites on perishable items, non-human substrates

The bite marks human skin are by far the commonest bitten substrate that forensic dentists are asked to assess. However, bites can occur in many other substrates and case reports describe things such as apples, cannabis resin, sandwiches, bank books, pencils, pacifiers, Styrofoam cups, envelopes, and, of course, cheese. The forensic value of bites in such materials is based upon the nature of the material itself, i.e a bite in styrofoam is likely to yield more information than one on bread and cheese more so than on an apple and, in the case of perishable items, how long the bite took place and what steps were taken to preserve the object [10]. The collection of a DNA swab from such items should always be considered and the double swab technique, with adequate drying and storage, should be the method of choice.

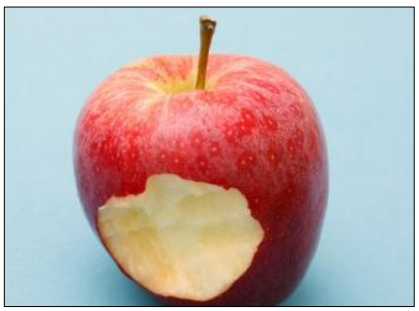


Fig 3: Bite mark on non-human substrate, perishable items

Conclusion

The field of bite mark science is aggrandizing, and the need for individuals trained and experienced in the cognizance, collection and analysis of this type of evidence is increasing. Conclusions from bite mark analysis can assist to answer some very imperative questions about the happenings at the crime scene thus helping the judicial system. Willingness by dentists to assist in this field can be invaluable in the resolution of abhorrent interpersonal crimes.

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