

A general review of bite marks evidence

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Abstract

In the new millennium, society is loaded with fresh challenges in every conceivable area which also include the crimes of different nature and intensity. Dentistry plays a small but significant role in the process of identifying victims of crime through dental records. The most common role of the forensic dentist is the identification of deceased individuals. One of the methods of identifying the culprits is by bite mark analysis though, human skin is subject to much distortion. The appearance of bite marks in human skin can be influenced by tissue distortion due to the mechanical properties of the skin. The unique nature of our dental anatomy and the placement of custom restorations ensure accuracy when the techniques are correctly employed.

Keywords: Bitemarks, Forensic Dentistry, Dental Evidence.

Introduction

As we enter a new millennium, society is faced with fresh challenges in every conceivable area. Despite leaps in modern technology, medical breakthroughs and the geographical changes that the last century has brought, crime still persists in all aspects of our lives. Through the specialty of forensic odontology, dentistry plays a small but significant role in this process. By identifying the victims of crime and disaster through dental records, dentists assist those involved in crime investigation. Always part of a bigger team, such personnel is dedicated to the common principles of all those involved in

forensic casework: the rights of the dead and those who survive them¹.

The most common role of the forensic dentist is the identification of deceased individuals². Dental identification takes two main forms. Firstly, the most frequently performed examination is a comparative identification that is used to establish (to a high degree of certainty) that the remains of a decedent and a person represented by antemortem (before death) dental records are of the same individual. Secondly, in cases where antemortem records are not available, and no clues to the possible identity exist, a postmortem (after death) dental profile is completed by the forensic dentist suggesting characteristics of the individual likely to narrow the search for the antemortem materials³.

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General characteristics⁴

Bite marks may be present as bruises, abrasions, indentations or lacerations. Most have an overall ovoid appearance. This ovoid area is generally made up of two or more arcs of rectangular patterns made by the incisal edges of individual teeth. Occasionally, only one arch registers and it is not uncommon to find multiple, superimposed bites. It is the registration of the size, shape, individual position and other specific features which make this patterned evidence unique and capable, in many instances, of linking the perpetrator to the crime.

Presentation of bitemarks injuries

Bitemarks will typically present as a semi-circular injury which comprises two separate arcs (one from the upper teeth, the other from the lower) with either a central area absent of injury, or with a diffuse bruise present. It is not unusual to see only one arch of teeth on an injury and, if this is the case, it is most often the lower teeth that are present which relates to the mechanics of biting, i.e. the maxilla remains stable while the mandible moves until the teeth meet.⁵

Classification of bite marks

Macdonald's Classification of Bite Marks⁶

Tooth Pressure Marks

Tooth pressure marks are caused by incisal edges of the anterior teeth. They are stable and subjected to minimal distortion.

Tongue Pressure Marks

Because of tongue pressure, impressions of the palatal surfaces of the teeth, cingulae or palatal rugae may be produced. This causes distortion of the marks.

Tooth Scrape Marks

Scrape marks are produced because of irregularities in the teeth due to fractures, restorations etc.

Complex Marks

Combination of any or all of the above marks.

The bitemarks severity and significance⁷

There are three main factors that influence the severity of a bitemarks injury:

- The force by which the original injury was inflicted;
- The anatomical location bitten; and
- The time elapsed between infliction of the injury and the presentation to the odontologist.

The severity of a bitemarks is an important factor within the assessment of the forensic significance of the injury and whether or not it can be compared with a suspect.⁷

Severity scale

1. Very mild bruising, no individual tooth marks present, diffuse arches visible, may be caused by something other than teeth- low forensic significance.
2. Obvious bruising with individual, discrete areas associated with teeth, skin remains intact, moderate forensic significance.
3. Very obvious bruising with small lacerations associated with teeth on the most severe aspects of the injury, likely to be associated as definite bitemarks, high significance.
4. Numerous areas of laceration, with some bruising, some areas of wound may be incised. Unlikely to be confused with any other injury mechanism and a high forensic significance.
5. Partial avulsion of tissue, some lacerations present indicating teeth as the probable cause of the injury. Moderate forensic significance.

6. Complete avulsion of tissue, possibly some scalloping of the injury margins suggested that the teeth may have been responsible for the injury. May not be an obvious bite injury- low forensic significance.

The most forensically significant bitemarks are those that fall in the middle of the severity scale, i.e. those that are too slight and those that are too severe rarely offer sufficient detail to be of forensic value.

Factors influencing bitemarks⁸

Type of tissue

In case of skin, if it is loose or with excessive fat bites commonly produce bruising leading to poor definition. In areas of fibrous tissue or with high muscle content tend to bruise less, so the definition of bite mark is good.

Age

Infants and old individuals bruise more than other age groups.

Sex

Females tend to bruise more than males. Once produced bite marks will be evident for longer period of time in females compared to males.

Medical Status

People having bleeding disturbances, under anticoagulant therapy and certain skin diseases bruise more.

Time

The time elapsed between actual biting and when the impression is made is vital. Depressions produced in the skin due to bite marks will recover within 10-20 minutes leaving swelling and discoloration.

Vascularity

The intensity of the discoloration may depend on vascularity of the area. Bruises will occur and last on a more vascular area like face than in the site which is less vascular like bite on hand or foot.

Collection of bitemark evidence

Bitemark evidence is collected from both the bite victim and suspect. The American Board of Forensic Odontology (ABFO) has published guidelines that described the evidence that should be collected from both victim and suspect and they represent a sound basis for such collection.⁹

Collection of bitemark evidence from the bite victim¹⁰

The most important item of evidence from the bite victim is photography. Numerous photographs of the injury should be taken. All of the photographs should be taken with the camera at 90° (perpendicular) to the injury. It is been recommended that bitemarks be photographed at regular 24 hour intervals on both the deceased and living victim as their appearance can improve.

Following photography a number of other items should be collected:

Dental impression of the victim

This is to exclude them as self-biting and for comparison to any bite injuries that may be discovered on a suspect.

DNA swabbing of the injury site

This should be a double swab – the first moistened with distilled water and the second dry.

Impression of the bite injury

This should only be performed if a significant degree of three-dimensional detail is present

Skin removal

Recommended by certain authorities as it permits trans-illumination of the bitemarks.

Collection of evidence from the bite suspect¹¹

The collection of evidence from the bite suspect must commence only after proper consent has been acquired. Once authority has been obtained, evidence collection begins, again, with copious photography. A thorough dental examination should be undertaken and a dental charting produced detailing the presence and condition of each of the teeth, as well as noting any recent dental treatments or dental modifications that have been undertaken. The next stage is to take two high quality impressions of both the upper and lower arches. If the individual wears a dental prosthesis, impressions should be taken with this being worn and also without.¹²

Analysis of bitemarks*Odontometric Triangle Method*

In this objective method a triangle is made on the tracing of bite marks and teeth models by marking three points, two on the outer most convex point of canines and one in the centre of the upper central incisors. Three angles of the triangles are measured and compared.

Comparison Techniques

Comparison techniques can be classified as direct and indirect methods. They use life size 1:1 photographs and models of teeth. In assisted comparison method, specialized techniques such as microscopic methods,

radiographs or experimental bite marks are used.

Direct Method¹³

Model from suspect can be directly placed over a photograph of the bite mark to demonstrate concordant points. Videotape can be used to show slippage of teeth producing distorted images and to study dynamics of the bite marks.

Indirect Method

This method involves preparation of transparent overlay of occlusal or incisal surfaces of the teeth which are then placed over the marks on the photographs. Overlays may be produced by tracing the occlusal surface of teeth by placing cellulose acetate paper over the model, Xeroxing the model on the transparent sheet, use of reverse negatives which preserves the anatomical details recording bite in a wax sheet or sprinkling radio-opaque powders into the teeth impressions, then producing a radiograph. CT scan can be used to produce overlays of the dentition at varying depths. This is considered to be an accurate method of overlay production¹⁴.

Special Methods in Bitemarks Analysis*Stereometric graphic analysis*

This can be used to produce contour map of the suspects dentition.

Experimental Markings

Experimental bite marks may be produced on the pig skin, bakers dough or rubber for analysis.

Accuracy of bitemarks in human skin¹⁵

The main challenge in forensic dentistry is the analysis of bite marks in human skin and

this can be primarily attributed to the fact that a bite injury is subject to much distortion. The appearance of bite marks in human skin can be influenced by tissue distortion due to the mechanical properties of the skin. These properties are related to the underlying collagen and elastic fibres in addition to other structures such as proteoglycans.

The composition of these underlying structural components varies across different locations on the body. To illustrate this simply, the underlying tissue in the back varies significantly to that of the breast; therefore the degree of tissue distortion possible at each site may differ greatly. Bite mark deformation which is influenced by its anatomical location has flow-on effects on the registration of both class and individual tooth characteristics. In addition, movement of the victim during bite infliction would increase this distortion. Current research investigating the biomechanics of skin to explain the distortion inherent in bite mark injuries is aimed at bridging some of the discrepancy that is observed between a dentition and the resulting injury¹⁶. Another difficulty facing forensic dentists is the changes that occur to an injury as a result of the human healing processes. Again, this is also a poorly understood area and – because the healing process is swift – this results in rapid loss of evidence if the injury is not reported immediately.

Conclusion

Forensic dentistry plays a major role in the identification of those individuals who cannot be identified visually or by other means. The unique nature of our dental anatomy and the placement of custom restorations ensure accuracy when the techniques are correctly employed.

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