IJIRR

International Journal of Information Research and Review
Vol. 10, Issue, 08, pp.7557-7559, August, 2023

RESEARCH ARTICLE

REVIEW PAPER ON COMPLETE METHODS FOR THE ANALYSIS OF HUMAN BITE MARKS

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ARTICLE INFO

Article History:
Received 16th May, 2023
Received in revised form
17th June, 2023
Accepted 20th July, 2023
Published online 30th August, 2023

Keywords:

Forensic odontology,
Bite marks, Humans,
Uniqueness, Individuality.

ABSTRACT

In comparison to other mammals humans as well as their teeth grow up slowly. Forensic odontology is a branch of forensic science that studies about the teeth, their growth and development as well as the crime associated with it. Not only for chewing purpose teeth do play an important role in criminal investigation through bite marks as they carry DNA and are unique. In this paper, various methods are studied for the analysis of bite marks.

INTRODUCTION

Forensic Odontology or Dentistry is the branch of forensic science in which application of dental structures through which identification of either the criminal or the victim can be done, where fingerprint analysis fails (1).Human teeth can act as a weapon since ancestral world. It can be the weapon of annoyance, weapon of happiness, weapon of wreck-ling etc (2). Bite mark is based on the principle that "no two bite marks are alike". Bite-mark is a mark which is created either by a single tooth or by group of teeth. These are individualistic that means no two individuals can have the same pattern of bite-mark (3).The bite marks are found mainly on cases such as rape, sexual assault, homicide, child abuse ahead with other injuries including abrasions, contusions, lacerations and usually on different body parts depending upon the crime (4).It can be on ear, arm, face, breasts, lips, hand ,buttocks, female genital, legs, shoulder (5). According to Furness; a criminal can lie but his or her teeth cant lie (6). According to Sweet; bite-marks are unique that no two individuals can have same bite mark pattern (7). The first forensic dental identification case in India was described in detail as a review by Sansare and Dangal in the year 1995 (8). During the course of bite mark, there are three proceeding arrangement takes place that includes the movement and biting force of mandible (lower jaw), the immobilization of maxillary (upper jaw) and the reaction of the victim on which the process of biting takes place (9).

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Types of teeth

There are mainly 4 types of teeth present in human mouth. These are

- **Incisors:** These are eight in number used for biting of the food and also in case of bite marks these play a very important role.
- **Canines:** These are four in number and are the sharpest teeth that are helpful in tearing of the food.
- **Premolars:** These are eight in number and helps in tearing and crushing of food.
- **Molars:** These are four in number and function similar to that of premolars.
- Out of all these, during bite- marks the incisors and canines plays an important role. And the dental formula for teeth is 2123/2123.

Nature of human bite mark: Usually the human bite mark is of the shape of broad U or semicircular due to the pressure applied by incisors and/or canines with the presence of gap in between which shows the upper side as upper jaw and lower side as lower jaw (10).

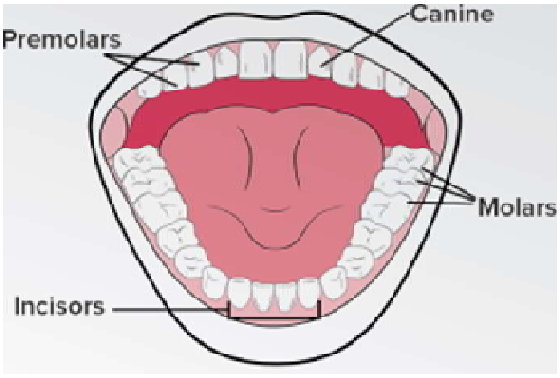


Image showing types of teeth present in human mouth.

Collection of bite marks evidences from victim: Saliva swab of bite marks - Saliva is the supreme biological evidence as it contains DNA that are mainly found in the cases like bite marks, lip marks and cases where oral cavity used. Through saliva , one can know the species origin ,its genetic makeup and many more. The saliva collection is done accurately through double swab method, using wet and dry cotton swabs. This is done antecedent to photography. The chief aspect of this method is, it should analyzed as soon as possible or preserved in refrigerate (11)

Photography: The most important step in collection of bite mark evidence is photography that is done for future use also. In case of advance photography, the stains of saliva can be photographed, even if the mark is not present. For photography, extra-oral photography and intraoral photography is done. Extra oral photography includes profile views and full face whereas intraoral photography includes frontal view, lateral view, occlusal view along with maximum opening of the mouth are being photographed by the forensic dentist. Regular photograph are taken after 24 hrs. The DSLR (digital single lens reflex camera) is used and photograph is taken perpendicular to the injury. Following parameters are important;

Close and far photography.
By on and off the flash light.
By using certain filters.
Black - white and coloured photographs.

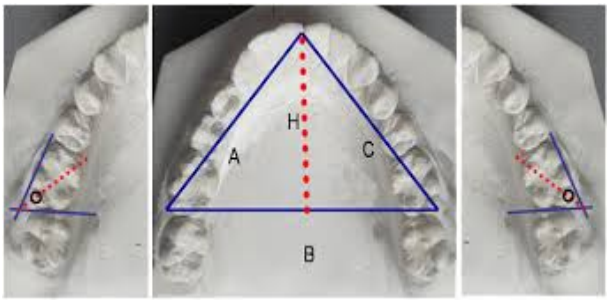
With or without the use of ABFO number 2 scale. In cases such as tissues are injured and crushed that leads to internal haemorrhage , where one wants to enhance the tattoos Infra red photography is used. UV photography is used for detailed study of bite-marks present on the skin. Fluorescent photography is used to distinguish between the injured skin and the healthy skin (12). ABFO scale. Through different photography techniques , different and detailed regarding the bite mark can be studied which may be helpful for various proceeding for the case.

Methods for the analysis of human bite marks

Following are the different methods opt by the experts to proceed with the analysis. These are

Odontometric triangle method: In this method, a triangle is made on bite mark tracing and named as A,B and C.

In which A and B is marked on frontal canines teeth where as C is marked in between the central incisor and a triangle is formed named as ABC triangle. And then lines name as AB , AC, BC are measured and angles in between them that are a , b , c are calculated. This method is applied on upper and lower jaw and then matched with the suspected bite mark present on any surface (13).



Comparison techniques - It can be through two ways Direct comparison Indirect comparison.

In case of Direct comparison method, the impression of suspect bite mark is placed on the 3- D photograph and then further analysis is done Video tapes can also be used to demonstrate the bite mark and the force applied on to the surface in slow motion. And in case of Indirect comparison method ,overlay casts are used. In this impression of bite mark is taken on acetate sheets which are colourless and transparent in nature and then the information from these sheets are transferred on the casts that are prepared already.There are mainly two types of overlay casts that are used, these are hollow volume overlay, filled volume overlay, compound overlay (14)

Vectron - In this method, angles and fixed bite marks distance are measured (15).

Image Perception Software Procedure: It is a new method of examine and differentiate the photograph of bite mark with that of the suspect dentition cast through image perception software. In this , a photograph having bite mark is taken with the help of software and area of interest is selected that are marked with different colour so as to highlight them. Now the selected coloured area is layered over the original photograph using Photo-shop of Adobe System (16). Another software that is used is Dental Print that was developed by Department of

Forensic Medicine and Forensic Odontology in the University of Grenada . Martin - de las Heras *et al*. conducted a study to know which above two mentioned software are best through their sensitivity, reliability and concluded that Dental Print is far better than Photo shop of Adobe System (17).

Stereo-metric Graphic Analyses: In this method , an outline of the bite mark or either the tooth is made in great detail and 3- D model in the form of contour map is studied (18).

D scanners in tooth mark analyses - This 3d scanners collect all the structural information from the surface and on that bases forms a reconstruction of that surface. There are two types of scanners - laser scanner and contact scanner. Laser scanner uses the laser beam to emits the light and then returns back with the help of recorded information of the object by triangulation. Numerous shots are made through laser beam in order to record the whole information. The advantage of this method is easy to use and gives fast results. Another method is contact scanner, examine the surface of the object with the help of probe and multiple sensors are attached through which information is gathered and reconstruction of the bite mark is made. The disadvantage of contact scanner is difficult to use and time consuming method (19).

CONCLUSION

Bite-marks are very important and valuable in solving the crime, if properly examined. These bite marks can help in identifying the culprit as these can stand in extreme conditions and are utmost evidence for identification. As this branch of forensic dentistry is new and upgrading, so experts are to be required in-order to solve the crime. Since, forensic science in India is developing day by day so the above mentioned methods may be upgraded according to the advancement.

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