EVALUATION OF BITE MARKS ON SKIN AND AN IN ANIMATE OBJECTS: AN ORIGINAL RESEARCH

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ABSTRACT

Aim: The objective of the study is to compare the accuracy of bite marks on an inanimate substance (fruit) and a living tissue (skin) using digital analysis.

Methodology: A cross-sectional study was conducted involving 15 volunteers. The registered bites of individuals on inanimate object (fruit) and living tissue (skin of forearm) were photographed with the American Board of Forensic Odontology scale No. 2 in the view field immediately after the production of bite marks. Dental casts of the individuals were obtained and photographed out of which computer-assisted overlays were generated, and analysis was carried out digitally using Adobe Photoshop version 7. Statistical analysis was performed using IBM SPSS software, version 22.

Results: Skin had a comparable accuracy to that of an inanimate object which is statistically attested.

Conclusion: The source of bite marks, the substrate onto which they are generated and the technique of lifting the bite imprints serve as important tools in analysis.

Keywords American Board of Forensic Odontology guidelines, bite marks, Forensic odontology.

I. INTRODUCTION

Bite marks are often observed at crime scenes on various parts of the human body, although they are more common in certain parts of the body. In addition, no body part is immune to bite marks. These marks are not uncommonly observed in physical assault cases but are more common in sexual assault cases and are observed in both homosexual and heterosexual cases. These pieces of evidence have been used successfully to prosecute offenders. Bite marks have also been observed on various edible leftovers at the crime scenes and these bite marks have also been used as evidence for identifying the criminals. Bite marks on inedible objects have also been reported, including on soap and bullets. Bite marks have also been studied on clay, and one case has been solved based on bite marks on clay. According to Pretty and Turnbull, the central dogma of bite mark analysis is based on two assumptions. The first is that human teeth are unique, and the second is that sufficient
In the present study, evaluation of the maxillary bite imprints on skin asserts that the percentage of overlays with
Grade A superimposition was 24%, and Grade C accounted to be 20% . Evaluation of the mandibular bite imprints on
skin neither distorted nor deteriorated placing the American Board of Forensic Odontology (ABFO) scale No. 2 in the
view field immediately after the production of bite marks to generate life-size images for analysis. The
volunteers were then made to bite on their forearm after disinfecting the site. The registered bites were
photographed in a similar procedure placing ABFO scale No. 2 in the view field immediately after the production
of bite marks. Dental casts of the individuals were obtained using alginate impression material and dental stone.
They were photographed and all the life-size images were collected with the reference scale in the field of view.
The images were then subjected for digital analysis using Adobe Photoshop (Version 7). The overlays obtained
from bite marks on living tissue (hand) and the inanimate object (fruit) were compared individually with the
overlays of dental casts by superimposition method.[4] When the overlays of incisal edges and cuspal tips of all
the anterior teeth were apparently superimposed on to the ones generated from bite mark overlays with the
alignment of each tooth and anterior arch as a whole, a Grade A was given. When the overlays were comparatively
superimposed but not accurate in terms of alignment, a Grade B was assigned. No single tooth in an arch among the
registered teeth in a bite mark overlay is superimposed onto the ones on dental cast; a Grade C was allocated. The grades obtained separately on living tissue and an inanimate object were compared for the
accuracy of the objects for bite marks production and their analysis. The collected data were analyzed with IBM
SPSS statistics software 22.0 Version. To describethes data descriptive statistics frequency analysis, percentage
analysis was used. To find the significance in categorical data, Chi-square test was used. In the above statistical
tools, the $P < 0.05$ is considered as significant level.

III. RESULTS
In the present study, evaluation of the maxillary bite imprints on skin asserts that the percentage of overlays with
Grade A superimposition was 20%, Grade B accounts to be 24%, and Grade C was found to be 56%, whereas on
fruit (inanimate object), the percentage of overlays with Grade A superimposition was 56%, with Grade B the
percentage was 24%, and Grade C accounted to be 20%. Evaluation of the mandibular bite imprints on skin

AIM OF THE STUDY
This study aims at the evaluation of the bite marks for analysis on a living tissue like skin and an inanimate object
like fruit. The objective of the study being the appraisal of the accuracy of registered bite marks on respective
substrates using digital analysis.

II. METHODOLOGY
Fifteen volunteers participated in the study and informed consent was obtained. The individuals participating in
the study were asked to bite on an inanimate substance such as fruit with a pressure sufficient for the bite
imprints to be generated with a care that the food substance (fruit) is not sheared. The bite marks thus imprinted
on the surface of fruit were recorded using a camera immediately with a care that the registered bite marks were
neither distorted nor deteriorated placing the American Board of Forensic Odontology (ABFO) scale No. 2 in the
view field immediately after the production of bite marks to generate life-size images for analysis. The
volunteers were then made to bite on their forearm after disinfecting the site. The registered bites were
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tools, the $P < 0.05$ is considered as significant level.
asserts that the percentage of overlays with Grade A superimposition was 20%, Grade B accounts to be 32%, and Grade C was found to be 48% [Table 1, 3], whereas on fruit (inanimate object), the percentage of overlays with Grade A superimposition was 56%, with Grade B the percentage was 36%, and Grade C accounted to be 8% [Table 2, 4]. Although clinically, the percentage of distribution asserts that the fruit has a better accuracy in registration and analysis of bite marks, the statistical analysis was not in accordance with the same ($P > 0.05$).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Maxillary</th>
<th>N (%)</th>
</tr>
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<tbody>
<tr>
<td>Grade A</td>
<td>5 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Grade B</td>
<td>6 (24.0)</td>
<td></td>
</tr>
<tr>
<td>Grade C</td>
<td>14 (56.0)</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Grade</th>
<th>Mandibular</th>
<th>N (%)</th>
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</thead>
<tbody>
<tr>
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<td>5 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Grade B</td>
<td>8 (32.0)</td>
<td></td>
</tr>
<tr>
<td>Grade C</td>
<td>12 (48.0)</td>
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IV. DISCUSSION

The exact identification of a living person using individual traits and characteristics of the teeth and jaws is the basis of forensic science. The bite marks left on a person may be used to identify the perpetrator. Bite mark identification is based on the individuality of a dentition, which is used to match a bite mark to a suspected person. One can exactly match the bite marks to the accused biter’s dentition. The most important step in bite mark analysis is to recognize a patterned injury as a human bite mark followed by pattern analysis of the bite mark which provide the individual information about the suspect or an offender and relate the person who is involved in the crime. Bite marks with high evidence value that can be used in comparisons with the suspects’ teeth will include marks from specific teeth that record different characters. The surface abrasion or sub-surface haemorrhage caused by human bites appears as an arch. They are caused by the incisors, canines and premolars. Contusions are the most common type of bite mark. It can be determined from the type of bleeding under the skin whether the victim was alive or dead at the time the bite mark was delivered. In a study by Gorea et al., skin of the volunteers was used, and it was observed that a match was possible in 60% of cases. The reason for the higher percentage of identification could be contributed to a different classification from that of the present study and a very small sample size (only 25 cases). Whittaker reported that matching of the bite marks on animal skin corresponded in only 76% of the cases. The percentage of nonsuperimposed overlays on the fruit in maxilla was 20% and on mandible 8%. Although stated in the study by Gorea and Jasuja et al. that exanimate object like clay has a better accuracy, this imprecision of mandibular overlays on fruit can be attributed to the fact that the quality of bite imprint is not only determined by the type and consistency of the substrate but also the biting process as a whole. The variability in the degree of superimpositions among maxillary and mandibular bite imprints can be attributed to the bite mechanism which is when the teeth apply pressure on the substrate with a varied force. It begins with closure of mandible, followed by a negative pressure from the suction of skin or any other substrate, and the tongue thrust from the opposite direction; therefore, there would be projection of teeth edges and palatal surfaces. However, in our study, patterns from other mouthparts or alterations in the bite patterns due to the pressure from other mouthparts was not perceived since all the participants were elucidated the kind of bite imprints appropriate for their analysis and the agendum was subjective. When an individual bites something, the
superior teeth stabilize the object, while the inferior teeth try to cut it. The indentation created by the superior teeth is significantly important to obtain information such as dental alignment, size, and shape of dentition. The factors which influenced the accuracy of bite mark analysis in our study were physical nature of the foodstuff, the biting force with which bite mark was done. The time lapse in collection of the imprints was negligible which serves as an important factor when perishable substances are used for bite mark analysis.

V. CONCLUSION

The importance of bite marks and their analysis in forensics is well asserted. The source of bite marks from which they are produced, the substrate onto which they are generated and the technique of lifting the bite imprints serve as important tools in analysis and identification. Although inanimate objects serve as a better sources for analyzing bite marks, when collected immediately with an appropriate technique skin has an equivalent accuracy in bite mark analysis.

REFERENCES


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