

Identification from bite marks in a sexual assault case involving multiple assailants by DNA profiling

Rajinderpal Singh, Indian Armed Forces (AD Corps), BBS, Memorial Charitable Hospital, Urmar Tanda
Pankaj Mahla, Indian Armed Forces (AD Corps), BBS, Memorial Charitable Hospital, Urmar Tanda
Rakesh.K.Gorea, Faculty member, College of Medicine, Prince Sattam bin Abdul Aziz University, Al Kharj -Saudi Arabia.
Sarabjeet Singh, Senior Forensic Chemical Examiner/Asstt. Director, DNA/ BIOLOGY Division, Forensic Science Service, Govt of National Capital Territory, New Delhi.
Yashmeen Sharma Department of DNA Fingerprinting, Forensic Science Laboratory, Govt. of National Capital Territory, New Delhi.

Citation: Singh R, Mahla P, Gorea RK, Singh S, Sharma Y. Identification from bite marks in a sexual assault case involving multiple assailants by DNA profiling. *Int J Eth Trauma Victimology* 2017; 3(1):43-46. doi: 10.18099/ijetv.v3i1.8797

<p>Article history</p> <p>Received: April 22, 2017 Received in revised form: May 7, 2017 Accepted: May 12, 2017 Available online: August 20, 2017</p>	<p>Abstract</p> <p>Bite mark evidence is often introduced as being close to DNA in terms of accuracy. Bite marks are generally found at the scene of violent crime murders, sexual assaults and are an extremely difficult process to collect the bite marks/saliva sample very lightly, otherwise, only victim profile will be generated. On examination of victim's right breast, a patterned injury was discovered and determined to be from adult male's teeth. Evidence was collected by the forensic doctor according to established techniques including recovery of saliva from the bite mark area despite the body. DNA analysis by PCR using polymorphic STR markers revealed a DNA profile of mixed origin. With the advent of more sensitive typing methodologies, fingernails clipping for foreign DNA, as well as swabs collected from the area on the victim's body (kissed, licked, genital area, bitten area from breast and lips), are analyzed. In addition, finger swabs for nail scrapping in the case of digital penetration could also be collected from the suspect for DNA analysis, findings new repeats of DNA. Generally, Victim's DNA profile, a genotype contribution from the perpetrator was identified as a minor component. Thus the DNA typing results from the bite mark correlated with the DNA typing results obtained from other biological trace evidence identified from the victim's genital samples. The bite mark and the DNA evidence were used to screen suspects and played an important role in obtaining resolution of this case. In this study DNA profiled from the breast swab from bitten area, finger swabs, and a control sample of assailants were obtained for all STR loci using Ampf/STR Identifier kit.</p>
<p>Corresponding author</p> <p>Dr. Sarabjeet Singh, Ph.D., Senior Forensic Chemical Examiner/Asstt. Director, DNA/ BIOLOGY Division, Forensic Science Service, Govt of National Capital Territory, New Delhi.</p> <p>Phone:+91 Email: drsinghdna@gmail.com</p>	

Keywords: Forensic Science, Bite marks, Saliva, STRs, DNA Profiling, Rape cases. © IJETV. All rights reserved

Introduction
 Use of DNA in bite marks was pioneered in an effort to eliminate the subjectivity associated with

the conventional analysis. Bite marks are found on materials like skin, clothing, soft tissue and the recovery of DNA from saliva has been reported.

When it comes to the sources of DNA evidence, the fastest growing segment is referred to as "touch DNA." Touch DNA encompasses scenarios where a person comes into contact with another person or object for a period of time, thus leaving some biological material behind. Human mouth contains over 500 distinct species of bacteria, and every individual will have a slightly different combination, dependent on oral hygiene status, dental status and presence or absence of prosthesis. One research group has suggested that the genotypic identification of oral streptococci may be of use in bite mark analysis. Therefore, it appears that the technique is a valuable addition to forensic dentistry although its use will be limited by the access to the expertise and equipment to undertake it (1). Touch DNA is often enormously important in the analysis of guns, knives, tools, and other implements used in property crimes. With the advent of touch DNA, the possibilities for recovering biological evidence appear to be limitless. Touch DNA can also be recovered in some cases from articles of clothing (e.g., headband of a hat, the waistband of underwear, bra clips, or buttons on pants).

The ability to develop a DNA profile from bite area is affected by three critical components

1. The length of time the subject was in contact with the object.
2. The amount of force applied when biting the victim body.
3. The number of other individuals who potentially touched the victim's body.

Material and Methods

Saliva Swabs: Saliva will have been deposited on the skin during biting or sucking and this should be collected and analyzed (2).

Prototypical human bite mark consisted of an elliptical pattern of marks from individual teeth around a perimeter of abrasions and contusions (3).

Extraction of DNA:

DNA was isolated using phenol chloroform extraction method and Automated Extraction by Express system (Applied Biosystem/Thermo Fisher) (4).

DNA typing

Fifteen STRs plus Amelogenin of human genomic DNA were amplified by 9700 Real time PCR/Thermal cycler. The Autosomal/Identifier Ampf/STR STRs kit was used for PCR amplification and gene mapper software is used for DNA Profiling (STR analysis) and the allelic ladder was

used as a standard to determine the allelic size of the STRs.



Fig 1. Saliva deposited on breast skin during biting force or sucking

Results & Discussion

A total number of alleles were identified in 15 STRs plus Amelogenin locus and DNA frequency distribution of STR loci from victim and suspects are described below and the results for the 16 Polymorphic STRs loci are shown in (Table 1). All the DNA profiles were obtained from breast swab of victim samples, which could be compared with accused blood samples for confirmation. DNA profile generated from the source of exhibits 1st, 2nd and 3rd of suspects is matching with the DNA profile generated from the source of exhibits of victim breast, lips and thigh swabs (Table 1). STRs were amplified in breast DNA samples extracted from saliva deposited on the skin. It can be seen that the DNA profiles obtained from the male DNA fraction from bitten area of breast swab correspond to those suspects and victim respectively. However, in the present study, the DNA quantity from saliva deposited samples was sufficient for PCR amplification and DNA typing. Allele size of all suspects' saliva samples and high level of STRs diversity was noted. It is important to consider that there is contact between lips, teeth, and skin, where Saliva/buccal cells are impregnated on the skin, which can increase cell quantity. In this case, there is tissue invasion, with the possibility of mixing the victim's and the aggressor's DNA. When there are mixtures, and contamination can be recognized during case

investigation, comparing the victim's DNA and the DNA of the suspects. However, in this research,

the results showed that DNA samples from skin-deposited saliva were mixed DNA profiled.

Table 1: Genotype analysis for establishing identity from saliva samples

i1) D8S1179 ii) D21S11 iii) D7S820 iv) CSF1PO v) D3S1358 vi) TH01 vii) D13S317 viii) D16S539 ix) D2S1338 x) D19S433 xi) vWA xii) TPO X xiii) D18S51 xiv) D5S818 xv) FGA AND AMELOGENIN

Loci	1) Victim Breast swab		1 st Accused Blood sample		Genotype Range		2) Victim Lip swab		2 nd Accused blood sample		3) Victim Thigh swab		3 rd Accused blood sample		Genotype range	
D8S1179	13	15	13	15	12	18	12	15	12	15	13	17	13	17	12	18
D21S11	28	29.2	28	29.2	28	32	28	31.2	28	31.2	32.2	33.2	32.2	33.2	28	32
D7S820	10	11	10	11	8	15	10	11	10	11	11	12	11	12	8	15
CSF1PO	12	14	12	14	8	14	12	13	12	13	10	12	10	12	8	14
D3S1358	16	17	16	17	12	18	15	17	15	17	14	15	14	15	12	18
TH01	6	7	6	7	6	9	8	9	8	9	6	8	6	8	6	9
D13S317	11	12	11	12	9	14	8	12	8	12	10	11	10	11	9	14
D16S539	9	11	9	11	9	14	8	9	8	9	12	13	12	13	9	14
D2S1338	22	23	22	23	20	25	23	24	23	24	24	25	24	25	20	25
D19S433	13	13.2	13	13.2	10	16	12	13	12	13	13	15	13	15	10	16
vWA	14	16	14	16	12	18	16	17	16	17	17	18	17	18	12	18
TPOX	8	10	8	10	6	11	7	8	7	8	9	11	9	11	6	11
D18S51	14	16	14	16	12	18	13	17	13	17	14	16	14	16	12	18
D5S818	12	13	12	13	12	18	9	11	9	11	9	13	9	13	12	18
FGA	22	23	22	23	20	25	22	22.2	22	22.2	22	26	22	26	20	25
AMELOGENIN	X	Y	X	Y	X	X	X	Y	X	Y	X	Y	X	Y	X	Y

Although mixtures can be present and confirmed by electropherogram no. with repeated contact by the perpetrators. DNA evidence was increasingly being relied upon by the courts and after 2005 amendment in the criminal procedure code. DNA profiling has now become a part of the statutory Scheme.

Conclusion

DNA profiling of bite marks in sexual assault case play a significant role in forensic dentistry and can assist judicial system. Moreover, our results indicate that standardized procedures for DNA collection and extraction from skin-deposited saliva can be very useful to help to solve criminal cases, since important data may be obtained using salivary DNA analysis. Therefore, the analysis of saliva deposited on skin can be incorporated into a criminal investigation and have great discriminatory power. The Serious nature of crimes in which bites are often dictates that

“Forensic Standard” should be established for gathering and interpretation of evidence. Errors in sampling, comparison, DNA analysis and interpretation of bite marks may lead to serious consequences. Further efforts to reduce subjectivity in standard physical techniques are required. However, the solution of a forensic case requires other important studies such as the physical bite mark and other evidence found at the crime scene that should be well addressed by the investigators. In Nirbhaya case the honorable court said, the police has adduced scientific evidence like DNA fingerprint analysis to established a clear link between the convicts and the incident. The bench also noted that there were various “white bite marks” on the victim’s body and such analysis report play an important role in criminal justice system. The recent advancement in modern biological research has regularized forensic science resulting in radical help in the administration of justice of Nirbhaya gang rape and murder case in Delhi 2012.

References

1. Bitemarks [Internet]. Forensic medicine for medical students. 2015 [cited 2017 Feb 4]. Available from: <http://www.forensicmed.co.uk/wounds/bitemarks/>
2. Sweet D, Lorente M, Lorente JA, Valenzuela A, Villanueva E. An improved method to recover saliva from human skin: the double swab technique. *J Forensic Sci.* 1997;42(2):320–2.
3. Sweet D, Pretty IA. A look at forensic dentistry – Part 2: Teeth as weapons of violence – identification of bitemark perpetrators. *Br Dent J.* 2001 Apr 28;190(8):415–8.
4. AmpFLSTR™ Identifiler™ PCR Amplification Kit [Internet]. Thermo Fischer Scientific. 2016 [cited 2017 Mar 4]. Available from: <https://www.thermofisher.com/order/catalog/product/4322288>