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(CASE REPORT)

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Importance of DNA profiling in sexual assault case: A case study

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Abstract

DNA profiling helps in solving many hidden secrets which is not always a simple task. In the present case study, a girl aged 06 years had been raped by a person of age 19 years at Bemetara district in Chhattisgarh, India. After filing the complaint by the victim's relative underwear, laggings, frock, vaginal smear slide, vaginal swab, vulval swab along with hair follicle and blood sample of the victim was collected by the medical officer during medico-legal examination. DNA was isolated from the above articles and the subsequent STR profiles were generated. Exhibits of suspect i.e. underwear, pubic hair and blood sample were also collected by the medical officer. DNA was isolated from these exhibits and the STR profiles were generated. DNA profiles of the victim and suspect were compared and the DNA profile of the suspect was found to be matched with the DNA profiles obtained from the exhibits of the victim.

Keywords: DNA isolation; DNA profiling; Rape; STR profile.

1. Introduction

Rape is the fourth most common crime against women and children in India [1][2]. According to NCRB data, the number of rape cases in Chhattisgarh reduced in the year 2021, still sexual assault cases persists. Numerous rape incidents are under-reported, with a very low conviction rate due to lack of evidence. This is because such crimes are committed in isolation, which removes the possibility of the witness being present. DNA profiling can play a significant role in displaying transparency in sexual assault cases which supports in sustaining the trust of the people in judiciary. The Nirbhaya case that occurred in 2012 led to major reform in sexual assault laws in India, including stepping up of trials and increasing punishments for offenders.

Biological evidence is sometimes the only way to establish the incidence of sexual assault and to identify the perpetrator. Nowadays, DNA identification of the suspect from the biological exhibits is considered to be the most important tool for court evidence [3][4]. Forensic DNA profiling uses short tandem repeat (STR) markers to determine human identity. Commercially available kits have been accepted on a global scale for multiplex PCR for biological samples [5].

2. Case History

An FIR was launched by police personnel under sections 376 (A, B), 376 (2), (f), 323, 363, 506 of Indian Penal Code and 4, 5 (l), 6 Protection of Children from Sexual Offences (POCSO) Act at the police station based on the information given by victim's relative, namely XYZ (Identity has been hidden), age 06 years raped by the suspect in a field near the pond. The exhibits of victim and accused were seized by the investigation agency. These exhibits were brought at State Forensic Science Laboratory (SFSL), Raipur, Chhattisgarh for further examination.

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3. Materials and Methods

Exhibits that were received at SFSL, Raipur, Chhattisgarh were marked as mentioned in the Table 1.

Table 1 Details of exhibits received at SFSL, Raipur, Chhattisgarh.

Sr. No.	Marked by Investigator	Exhibit	Seized From	Marked in SFSL
1.	A	Underwear	Victim	308
2.	B	Laggings	Victim	309
3.	C	Frock	Victim	310
4.	D	Underwear	Accused	311
5.	E	Vaginal smear slide	Victim	312
6.	F	Vaginal swab	Victim	313
7.	G	Vulval swab and Hair follicle	Victim	314G1 314G2
8.	H	Pubic hair	Accused	315
9.	I	Blood sample	Victim	316
10.	J	Blood sample	Accused	317

Samples from above exhibits were collected for isolation of DNA. Samples were mixed with 500µl of Prepfiler Express Forensic Lysis Buffer and 5µl of freshly prepared 1 M Dithiothreitol (DTT) for cell lysis. The extraction of DNA was performed by using Automated Express DNA Extraction System (Applied Biosystems). Extracted DNA was quantified through the instrument Real Time Polymerase Chain Reaction (RT-PCR) 7500 (Applied Biosystems) using Quantifiler Human Duo DNA Quantification Kit (Invitrogen from Applied Biosystems). The results were analyzed using software 7500 SDS v.1. Investigator® 24 Plex QSPCR Amplification Kit was used to multiplex PCR reaction of Autosomal STRs loci and Powerplex® Y23 System was used to multiplex PCR reaction of Y STRs loci on a GeneAmp 9700 Thermal Cycler (Applied Biosystems). The PCR products were then examined using Capillary Electrophoresis which was performed on an Applied Biosystems 3500 Genetic Analyzer. Sizing of the DNA fragments was analyzed using Gene Mapper IDX software v.3.1. The genotype or allelic distributions of the exhibits were obtained in the form of electropherogram that were displayed in the form of table.

4. Results and Discussion

Mixed autosomal DNA profiles were obtained from exhibit marked A, F and G of the victim. The autosomal DNA profile obtained from the exhibit marked J of the suspect was found to be included in the mixed autosomal DNA profiles obtained from exhibit marked A, F and G1 of the victim. The autosomal DNA profile obtained from the exhibit marked B and G2 of the victim and the exhibit marked D and H of the suspect were found to be identical to the autosomal DNA profile obtained from the exhibit marked J of the suspect. The autosomal DNA profile obtained from the exhibit marked C and E of the victim were found to be identical to the autosomal DNA profile obtained from the exhibit marked I of the victim (Table 2).

The Y DNA profile obtained from the exhibit marked B, F, G1 and G2 of the victim and the exhibit marked D and H were found to be identical to the Y DNA profile obtained from the exhibit marked J of the suspect. Partial Y DNA profile was obtained from exhibit marked A of the victim. Y DNA profile was not obtained from the exhibits marked C and E of the victim (Table 3).

Table 2 DNA profile obtained from Investigator® 24 Plex QS PCR Amplification Kit.

Genetic Markers	**Article J Exhibit 317/22**	**Article H Exhibit 315/22**	**Article D Exhibit 311/22**	**Article G Exhibit 314/22 G2**	**Article G Exhibit 314/22 G1**	**Article F Exhibit 313/22**	**Article E Exhibit 312/22**	**Article C Exhibit 310/22**	**Article B Exhibit 309/22**	**Article A Exhibit 308/22**	**Article I Exhibit 316/22**
TH01	6,6	6,6	6,6	6,6	7,8	6,7,8	7,8	7,8	6,6	6,7,8	7,8
D3S1358	16,16	16,16	16,16	16,16	16,17	16	17,17	17,17	16,16	16,17	17,17
VWA	16,18	16,18	16,18	16,18	16,18,19	16,19	16,19	16,19	16,18	16,18,19	16,19
D21S11	29,30	29,30	29,30	29,30	28,31.2	29,30	28,31.2	28,31.2	29,30	28,29,31.2	28,31.2
TPOX	11,11	11,11	11,11	11,11	8,11	8,11	8,11	8,11	11,11	8,11	8,11
D1S1656	12,17	12,17	12,17	12,17	11,14	11,12,17	11,14	11,14	12,17	11,12,14	11,14
D12S391	18,19	18,19	18,19	18,19	21,21	19,21	21,21	21,21	18,19	21,21	21,21
SE33	16,28.2	16,28.2	16,28.2	16,-	21,23.2	16,21,23.2,28.2	21,23.2	21,23.2	16,28.2	21,23.2	21,23.2
D10S1248	15,16	15,16	15,16	-,16	14,15	14,15	14,15	14,15	15,16	14,15	14,15
D22S1045	11,16	11,16	11,16	11,16	15,15	15,16	15,15	15,15	11,16	15,16	15,15
D19S433	14,17	14,17	14,17	14,17	13,14	14,17	13,14	13,14	14,17	13,14	13,14
D8S1179	15,15	15,15	15,15	15,15	13,15	15,15	13,15	13,15	15,15	13,15	13,15
D2S1338	24,26	24,26	24,26	24,-	20,23	23	20,23	20,23	24,26	20,23	20,23
D2S441	11,14	11,14	11,14	11,14	10,11	10,11,14	10,11	10,11	11,14	10,11	10,11
D18S51	14,14	14,14	14,14	14,14	14,15	14,15	14,15	14,15	14,14	14,15	14,15
FGA	20,26	20,26	20,26	20,26	24,25	26	24,25	24,25	20,25,26	24,25	24,25
D16S539	11,11	11,11	11,11	11,11	10,10	10,11	10,10	10,10	11,11	10,11	10,10
CSF1PO	11,12	11,12	11,12	11,12	12,12	11,12	12,12	12,12	11,12	11,12	12,12
D13S317	8,11	8,11	8,11	8,-	12,12	8,11,12	12,12	12,12	8,11	11,12	12,12
D5S818	10,11	10,11	10,11	10,11	11,13	10,11,13	11,13	11,13	10,11	10,11,13	11,13
D7S820	8,10	8,10	8,10	8,10	12,12	-	12,12	12,12	8,10	12,12	12,12

DYS391	10	10	10	10	----	10	----	----	10	----	----
QS1	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
QS2	S	S	S	S	S	S	S	S	S	S	S
Amelogenin	XY	XY	XY	XY	XY	XY	XX	XX	XY	XX	XX

Table 3 DNA profile obtained from Powerplex® Y23 System

Genetic Markers	**Article J Exhibit 317/22**	**Article H Exhibit 315/22**	**Article D Exhibit 311/22**	**Article G2 Exhibit 314/22**	**Article G1 Exhibit 314/22**	**Article F Exhibit 313/22**	**Article E Exhibit 312/22**	**Article C Exhibit 310/22**	**Article B Exhibit 309/22**	**Article A Exhibit 308/22**
DYS576	18	18	18	18	18	18	DNA profile not generated	DNA profile not generated	-	-
DYS389I	13	13	13	13	13	13			13	13
DYS448	-	-	-	-	-	-			-	-
DYS389II	29	29	29	29	29	29			29	29
DYS19	14	14	14	14	14	14			14	14
DYS391	10	10	10	10	10	10			10	-
DYS481	25	25	25	25	25	25			25	-
DYS549	15	15	15	15	15	15			15	-
DYS533	11	11	11	11	11	11			11	-
DYS438	11	11	11	11	11	11			11	11
DYS437	16	16	16	-	16	16			16	16
DYS570	17	17	17	17	17	17			17	-
DYS635	24	24	24	24	24	24			24	24
DYS390	23	23	23	23	23	23			23	-
DYS439	11	11	11	11	11	11			11	-
DYS392	10	10	10	10	10	10			10	11

DYS643	11	11	11	11	11	11			11	-
DYS393	15	15	15	15	15	15			15	-
DYS458	16	16	16	16	-	16			16	16
DYS385	13,17	13,17	13,17	13,17	13,17	13,17			13,17	-
DYS456	15	15	15	15	15	15			15	15
YGATAH4	12	12	12	12	12	12			12	-

Thus, in this case study complete DNA profiles were successfully generated from most of the exhibits of victim and suspect received in the laboratory. Interpretation of autosomal STR data revealed that the DNA profile generated from exhibit marked J (evidence from suspect) found to be included in the mixed DNA profile generated from the source of exhibit marked A, F and G1 (evidence obtained from victim). Furthermore, Y-STR data showed that the DNA profile generated from exhibit marked B, F, G1 and G2 (evidence obtained from victim) matched with the DNA profile generated from the source of exhibit marked D and H (evidence obtained from suspect).

5. Conclusion

After STR analysis, reports showed a perfect match between DNA profiles obtained from exhibits of the victim and suspect, confirming the suspect to be the culprit. Thus, DNA profiling is a reliable and robust genetic tool which has an important pivotal role in the society to solve crime and forensic case works.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was not required in the study.

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