

A Rape on a Minor Victim Under POCSO Act 2012 Investigation Through DNA Analysis Technique—A Case Study

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Abstract DNA profiling is a technique by which an individual can be identified at molecular level [1]. The use of DNA evidence in criminal investigation has grown in recent years. DNA testing has helped law enforcement agencies to identify criminals and solve difficult crimes such as rape, murder, murder with rape, paternity cases etc. The potential of DNA typing has made possible the resolution of immigration problems and complicated paternity testing. Rapid identification of individuals in mass-disaster (man-made such as explosions or natural such as earthquake, land sliding) using DNA typing has also been made possible. Computerized DNA database for the identification of criminal offenders have been created in some countries. DNA profiling is a powerful investigative tool because, with the exception of identical twins, no two people have the same DNA [2]. In other words, the sequence or order of the DNA building blocks is different in particular region of the DNA, making each person's DNA unique. DNA has great importance in criminal investigation cases such as murder, rape, disputed paternity, man-made disaster etc. This paper examines the science of DNA identification in rape case. It describes the main benefits and costs of the increasing role of DNA identification in the criminal justice system. The present work is to find out whether the accused is involved in the rape case scenario falling under protection of children against sexual offences Act 2012 with a minor victim. The case study was performed using the DNA isolation technique by the automated process and run on the

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instrument Genetic Analyzer 3500. The technique and results are discussed in the case study.

Keywords Rape • Minor • Evidences • DNA • PCR technique • Forensic investigation

Introduction

Violence against women and child is a serious global phenomenon, which results in physical, psychological or sexual harm to women and child. Such gender based violence includes rape, molestation, kidnapping and abduction of women and girls. Looking into seriousness and sensitivity of such crimes, police and law enforcement agencies are paying maximum attention on this issue. In such scenario collection of samples and their analysis is most important.

Now-a-days routinely used ABO blood grouping system is being replaced by more powerful DNA fingerprinting technique. Among the various new tools that science has provided for the analysis of forensic evidence DNA fingerprinting is the powerful and most valuable technique to generate the genetic profile of individuals from the biological samples [3].

DNA analysis, also called DNA typing or DNA profiling, examines DNA found in physical evidence such as blood, semen, saliva, hair and bone which determines whether it can be matched to DNA taken from specific individuals. DNA analysis has become an important form of evidence in criminal trials. It is also used in civil litigation, particularly in cases involving the determination of paternity of Identity.

In the present case study, the victim is minor, falling under 7 years of age who has been to the salon for a haircut. The assailant who is a barber by profession with cruel mind took the advantage of the situation and allegedly raped the victim in a shop. Taking into account the seriousness of incident the police officials rushed to the crime scene and collected the physical evidences pertaining to biological evidences from the crime scene. The exhibits were sent to the Regional Forensic Science Laboratory DNA was extracted using automated DNA extraction technique using PCR amplification by Genetic Analyser 3500 to obtain the DNA profiles.

Materials and Methods

The exhibits in the rape case which included the blood sample of accused and semen stain found on skirt of victim were analysed for preliminary semen test (Acid Phosphatase test and Choline test). Keeping in mind the importance of a case highly selective and specific technique of a DNA fingerprinting was used for such sensitive

case. DNA fingerprinting is highly advanced technique which is worldwide accepted. Following steps were performed to obtain DNA profile [4].

Isolation of DNA

In this case DNA was isolated from blood sample of accused and semen stain found on skirt of victim. Using prepfiler Automate Express kit and Automate Express (DNA extraction instrument) DNA was isolated from blood sample of accuse and semen stain found on skirt. Briefly the samples were lysed in lysis buffer (400 µl of lysis buffer + 10 mm Square semen stain)/(400 µl lysis buffer + 40 µl blood sample) and incubated at 56 °C for at least 2 h. After incubation the samples were centrifuged at 14,000 g for 2 min and loaded onto the Automate Express kit which has cartridges pre-loaded with reagents.

Quantification of DNA

Quantification of extracted DNA was performed using 7500 RT-PCR system and Quantifiler Human DNA Quantification kit (10 µl extracted DNA + 10.5 µl primer probe mix + 12.5PCR mix). The accurately quantified DNA was used for downstream application [5].

DNA Profiling

PCR amplification for generating DNA profile was performed on 9700 PCR machine using AmpFISTR identifiler plus PCR amplification kit (10 µl extracted DNA + 10 µl AmpFISTR identifiler plus master mix + 5 µl AmpFISTR identifiler primer set).

After PCR amplification the product were run on Genetic analyser 3500 (1 µl PCR product + 9 µl reaction mixture (i.e. 9.5 µl Hi-Di formamide + 0.5 µl Gene Scan 600 Liz size standard v2.0)).

The data was analysed on GeneMapper ID-X software. The profile generated was for 15 STR loci and gender Specific Amelogenin locus.

Results and Discussion

The stained skirt of victim was examined for semen with Acid phosphatase test and Choline test and was found to be positive. The samples were then subjected for DNA extraction and profiling. The automated DNA extraction procedure reduced

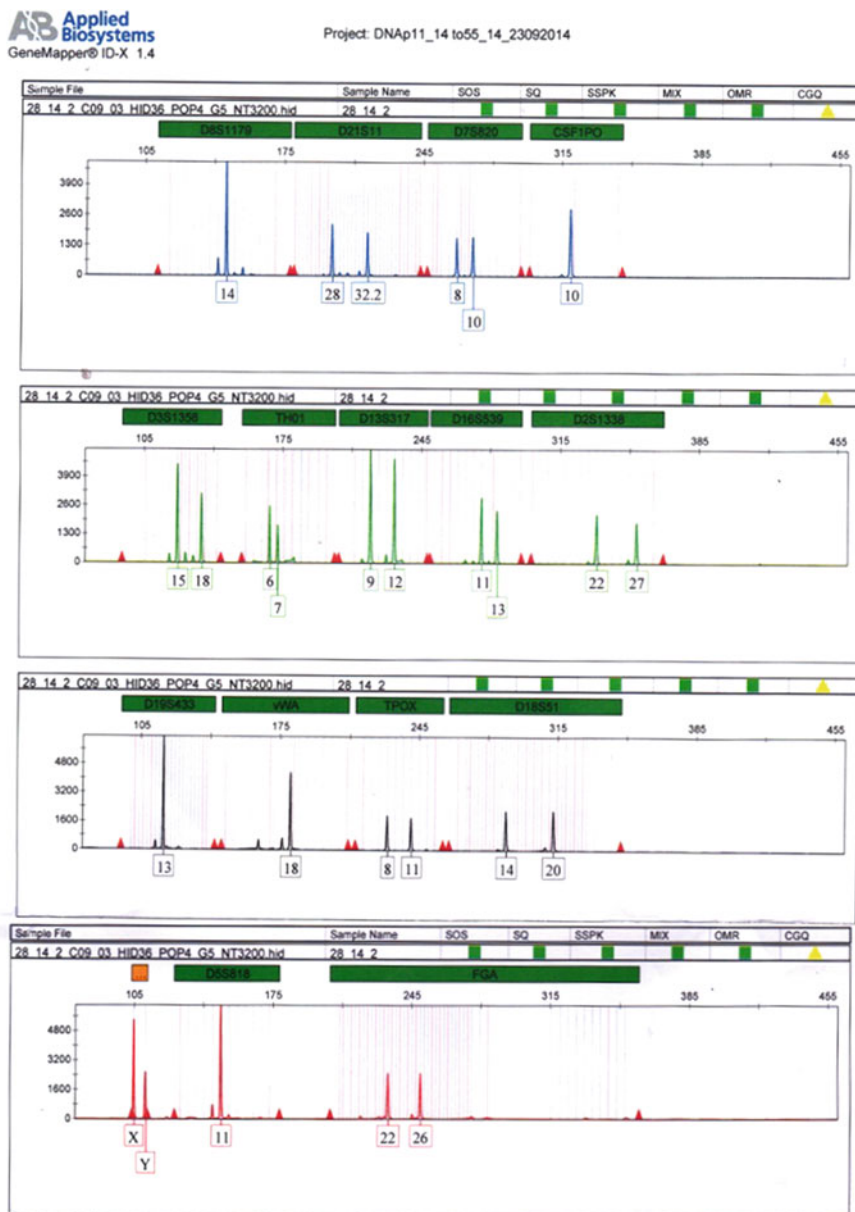


Fig. 1 DNA profile of semen found on skirt of victim

the time for DNA extraction, while the quantitation by Real Time PCR help ensure that the DNA is of human origin and accurately quantitated. The electropherogram [1] obtained from the GeneMapper for the exhibits were analysed and have been

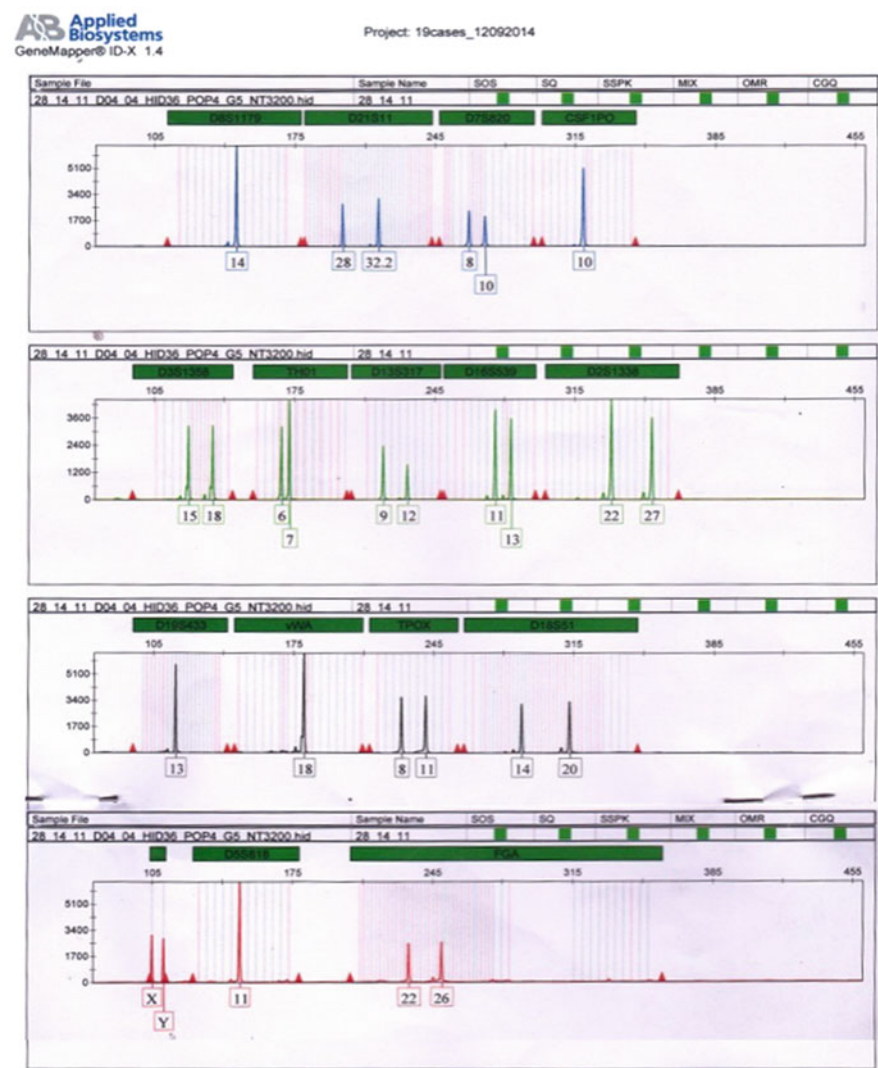


Fig. 2 DNA profile of blood sample of a Accused

Table 1 Tabulated results of DNA profile comparison

Marker	DNA profile of semen found on skirt of victim	DNA profile of blood sample of accused
D8S1179	14,14	14,14
D21S11	28,32.2	28,32.2
D7S820	8,10	8,10
CSF1PO	10,10	10,10
D3S1358	15,18	15,18
TH01	6,7	6,7
D13S317	9,12	9,12
D16S539	11,13	11,13
D2S1338	22,27	22,27
D19S433	13,13	13,13
vWA	18,18	18,18
TPOX	8,11	8,11
D18S51	14,20	14,20
AMEL	X,Y	X,Y
D5S181	11,11	11,11
FGA	22,26	22,26

found to be match at all loci. The electropherogram regarding the exhibits are as follows (Figs. 1 and 2, Table 1):

Conclusion

DNA evidence and typing procedures are uniquely useful in sexual assault cases because conventional analysis cannot differentiate between blood groups found in secretion stains containing both seminal and vaginal fluids [6]. Therefore, if the rapist and victim had the same blood group, the scientist would not be able to determine from whom the sample was derived. DNA analysis eliminates this problem, as current technology can distinguish between the DNA from the victim's vaginal tract and the rapist's semen. Forensic scientists need only a small sample of tissue, such as a hair or a spot of dried blood or semen for DNA analysis. To get a decisive match or exclusion, an expert makes a comparison of the DNA profile of the evidence sample with the profile of a blood sample taken from the suspect or victim. In theory, DNA-based profiles are better absolute identifiers than fingerprints because they are subject to less deterioration or tampering and more likely to be retrieved as evidence [7].

When the DNA profile of a known individual (A victim or suspect) matches the DNA profile from the crime scene evidence, the individual is "included" as a potential source of that evidence [8].

In the present case rapid analysis was possible due to automated extraction process. Automated extraction reduces turnaround time and time minimizing cross-contamination. Real time PCR helped to accurately quantitate the DNA and at the same time helps ensure that the DNA is from human origin. Accurate quantitation reduced reaction failure rates. The GeneMapper ID-X has an autobinning feature that increased accuracy and reduced manual intervention. Thus overall improvement in the process helped to obtain DNA profile from blood and semen. The DNA profile of the blood from the accused matched exactly with the semen found on skirt of victim. This helped to conclude that the accused was involved in the rape case.

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Next Generation DNA Led Technologies

Avadhanam, S.; Jyothsna, G.; Kashyap, A. (Eds.)

2016, X, 140 p. 50 illus., 40 illus. in color., Softcover

ISBN: 978-981-287-669-0