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DNA Evidence Collection in Sexual Offence Accused and Victim

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Abstract
DNA Forensics is a branch of forensic science that concentrates on the employment of genetic component in crime investigation, besides helping with human crimes like rape. DNA is the Nucleic Acid molecule that contains genetic information. All organisms carry various amounts of DNA which introduces many characters of organisms like hair and eye colours. Laboratory techniques could be used to recognize and isolate DNA and then to sequence it. In our study, we extracted DNA from different samples and amplified amylogenic gene to Identify gender for DNA typing, simultaneous performed RFLP and VNTR are the traditional genetic markers as well.
Keyword: DNA, Sexual offence, Nucleic acid

Introduction

As per sec. 53 crpc accused of the sexual offence have to be examined and his DNA sample also to be collected. To examine the victim of sexual offence should be done under sec. 164 A crpc and also required of sample collection for DNA examination.

DNA Forensics is a branch of forensic science that concentrates on the employment of genetic component in crime investigation, besides helping with human crimes like rape. DNA is the Nucleic Acid molecule that contains genetic information. All organisms carry various amounts of DNA which introduces many characters of organisms like hair and eye colours. Laboratory techniques could be used to recognize and isolate DNA and then to sequence it. DNA Sequencing includes figuring out the order of the four nucleotides in a strand of DNA the sections of DNA employed in DNA fingerprinting, though are highly variable, no child has pairs that their parents do not have. This means that by comparing large number of these sections, paternity, maternity, or even both could be found out. DNA fingerprinting has a very high successful and a low false rate, making it an extremely popular way of verifying paternity and maternity.

Various collection methods exist such as[1], cutting[2], FTA paper scraping[3], scraping of the surface of interest with wooden applicator stick[4], or sterile scalpel blade[5,6], taping[3,5,7,8,9] or vacuum sampling[2,10], and wet or dry, single or double swabbing[3,5,7]. Swabbing is the most versatile method and one of the most frequently used. At least, this is the case within the forensic units involved in this study. Over a number of years, they have been extensively using swabs for DNA collection, both for crime scene investigations

and laboratory examinations. Because of the increase in swab types available in the market, the promises of commercial arguments, and the results of various research studies conducted in controlled conditions with several swabs and/or swabbing conditions[11].

Materials and Methods:

DNA Evidence Collection

The following information may enhance the efficacy of the evidence collected by sexual assault examiners. Using today's DNA identification technology for example, DNA identification profiles are routinely detectable from saliva recovered from a cigarette butt or a bite mark, or from the cellular material adhering to the root portion of a single hair. A suspect's DNA profile may be determined from blood, semen, saliva, hair, or other body tissue that may be recovered in connection with a criminal incident.

Sexual Offense Evidence Collection Kit

Any dead or living matter, small or even minute can give us a lot of information. Samples like soil, glass paint, metal scraping, fabric or matter like Blood, Saliva stains, Hair can be useful. Various biological samples like Blood, Hair, and Nails were taken in the present study. Many types of kits are available for sample collection.

General Guidelines:

If the assault occurred within 96 hours of incidence, an evidence collection kit is used. If it is determined that the assault took place more than 96 hours prior to the examination then the use of an evidence collection kit is generally not necessary.

1. Blood sample should not be collected from person who undergone transfusion within 3 months before incident.
2. Any visible genetic disorder should be mentioned.
3. The samples are stored at only 4^0 C but wherever there is delay in either freezing or at second best, effective cooling should be carried out. For rural areas a thermocol box containing ice may be used.
4. The samples should be dispatched earliest. It should reach to laboratory within 72 hours after collection.
5. Do not dry stain sample by using hair dryer or under direct sunlight. Samples should be dried under shade only.
6. Teeth along with skull, which have been subjected to superimposition test, are not useful for DNA analysis. Few teeth could be recovered from upper and lower jaw before they are subjected to super imposition.
7. When very small quantity of DNA chain is available from a cell then P.C.R. technique is used. So, degraded or tiny samples may also be utilised.

The kit contains material sufficient for the collection of evidence from one person. Use a separate kit for each person. Change gloves for each step.

Blood Sample

The Blood Collection Kit would require qualified medical staff to perform the collection of the blood sample preferably 5 ml of blood should be withdrawn intravenously & pour it in a sterile plastic tube containing E.D.T.A. as a preservative and mixed it thoroughly so that anticoagulant spreads. It should be labelled and properly sealed. The tube should be placed in a container (e.g. thermos flask) containing ice. In case of infant's blood could be withdrawn from femoral vein puncture or heel puncture. 200-500 U.I. of blood is sufficient from infants. The sample should reach to laboratory within 72 hours and in case the laboratory cannot be reached within 72 hours, 1 ml of blood should be collected on a sterile Whitman paper- 3, air dried and sent to laboratory as a stain.

List of Evidence Collection:

1. Oral Swabs and Smears Two swabs are used simultaneously to patient's mouth and gum pockets. Both swabs are used to prepare one smear. The swabs and smear is allowed to air dry. When the slide is dry, write Oral on the slide and place in the slide mailer marked Oral[13]. Tape closed on one side only and completes the label on the mailer. The swabs are placed in the swab box marked "Oral." Both the mailer and the swab box are returned to the envelope. The envelope is sealed. The purpose of obtaining swabs and smears is to allow a forensic analyst to test for DNA evidence or microscopically for the presence of spermatozoa. If no spermatozoa are present, the analyst will then use the swabs to identify the seminal plasma components to confirm the presence of semen. Depending on the nature of the assault, semen may be detected on the clothing or skin, or in the mouth, vagina, or rectum and because there can be leakage of semen from the vagina or penis onto the anus.

2. Control Sample Buccal Specimen for Patient DNA Sample Instruct the patient to rinse the inside of their mouth by vigorously swishing with water. Using the special swab from the envelope marked "Buccal Specimen," collect a specimen by swabbing with a scrubbing motion between the cheek and the gums on both sides of the mouth. To assure a sufficient sample, the swab should be applied in a scrubbing motion for 15 to 20 times. The swabs are allowed to air dry. When dry, the swabs are placed in the box provided. The swab box is returned to the envelope. The envelope is sealed, and all of the information requested is filled out.

3. Trace Evidence To minimize the loss of evidence, lay a sheet of white paper (use exam table paper) on the floor then lay another piece of exam table paper on top of that. Preferably, in the presence of the examiner, the patient disrobes over the white paper, handing the examiner each piece of clothing as it is removed. This allows trace evidence to collect on the paper. Fill out the requested information on the envelope and then carefully fold the top paper and, place it in the envelope and seal.

4. Clothing The examiner should determine whether the patient is wearing the same clothing worn during or immediately following the assault. If the victim has changed clothes after the assault, it is recommended that an investigator go to the victim's residence to obtain clothing worn at the time of the assault. Clothing should be examined for any apparent foreign material, stains, or damage. An ultraviolet light source, which causes semen and other substances to become fluorescent when illuminated (Wood's lamp), can be used to detect stains on clothing. With patient consent, all items that may contain possible evidence related to the assault should be collected. Clothing is not shaken, as microscopic evidence may be lost. Any wet stains, such as blood or semen, should be allowed to air dry before clothing is placed into a paper bag. It is preferable that each piece of clothing be folded inward, placing a piece of paper against any stain, so that the stain is not in contact with the bag or other parts of the clothing.

5. Evidence Collection Underwear Wet or damp underwear should be air dried before packaging. The patient's underwear should be collected regardless of whether it was worn at the time of the assault. Fill out all information requested on the envelope; place underwear into the envelope and seal**.**

6. Dried Secretions and/or Bite Marks. An ultraviolet light (Wood's lamp) is used to identify areas of dried secretions on the patient's body. When dried secretion stains and/or bite marks are found, two swabs are used to collect the specimen. The swabs are moistened with 1-2 drops of water. Both swabs are held together to swab the area of the stain. Two complete sets of swabs and boxes are provided. The swabs are

allowed to air dry. When dry, they are placed in the swab box marked "Dried Secretions and/or Bite Marks," labelled with the site where collected on the body, and the nature of the secretion (if known), and replaced in the envelope. If additional swabs were used place them in a plain white stationary envelope and seal but do not lick the envelope. The information requested is filled in on the envelope and it is sealed. Semen and blood are the most common secretions deposited on the patient by the assailant.

7. Matted Material in Hair Where there is evidence of semen or other matted material on pubic or head hair; it may be collected in the same manner as other dried secretions. The swab is then placed in a small paper envelope and labelled "possible secretion sample from head (or pubic) hair". Although the specimen can be collected by cutting off the matted material, it is important to obtain the patient's permission prior to cutting hair**.**

8. Fingernail Scrapings It is important to collect evidence from each hand separately. Remove both bindles (paper towels) and scrapers from the envelope. Mark one bindle, Left, and one bindle, Right. One bindle is unfolded and placed on a flat surface. Use the scraper in the kit (an orange wood stick or cuticle stick will also work) to scrape under each nail. Each finger is held over the bindle when scraping, so that any debris present will fall onto the towel. After all fingers on one hand are done, the scraper is placed in the centre of the towel. The towel is refolded to retain the debris and the scraper. Repeat steps for other hand. Both bindles are returned to the envelope. The information requested on the envelope is completed and the envelope is sealed. Trace materials, such as skin, blood, hairs, soil, and fibres can collect under the fingernails of the victim and may provide useful evidence.

9. Pulled Head Hairs Pulled hair standards for evidence collection are considered by many to be very traumatic to the victims of sexual assault. Remove paper bindle from envelope. Using thumb and forefinger, not forceps, pull and do not cut, 5 hairs from each of the following scalp locations (for a total of 25 hairs): centre, front, back, left side, right side. Place pulled hair in centre of bindle and refold bindle. Fill out all information requested on the envelope; replace bindle into envelope and seal.

10. Evidence Collection Pubic Hair Combings A bindle (paper towel) is placed underneath the patient's pubic hair area. The pubic hair is combed in downward strokes, so that any loose hairs or debris will fall onto the bindle. The patient should always be given the option of combing their own pubic hair. The bindle is returned to the envelope. Fill out information requested on envelope; replace bindle into envelope and seal.

11. Control Sample Pulled Pubic Hairs Fifteen full-length hairs are pulled from various areas of the pubic region (using the gloved thumb and the forefinger - not forceps). When possible, it is advisable to offer the patient the opportunity to pull their own hairs. They are placed in the envelope. The envelope is sealed, and the information requested is completed.

12. External Genital Exam It is important for the examiner to complete a visual examination (including the use of magnification of the external genitalia). The examiner should identify trauma (e.g., laceration or contusion at the posterior fourchette) and document any trauma both by written documentation and forensic photography.

13. Evidence Collection Perineal and Anal Swabs and Smear Two swabs may be lightly moistened with 1-2 drops of water. Perineal swabs should be taken (even without history of

anal contact), as secretions may pool in this area. If both perineal and anal swabs are collected, it is preferable to make the slide from the anal swab. If only perineal swabs are to be collected, proceed as follows: Using two swabs simultaneously, moisten if necessary, with 1 or 2 drops of water, and with a rolling motion carefully swab the perineal area. Using both swabs, prepare one smear on the slide provided and allow to air dry (smear should be confined to the circle area on the slide). When slide is dry, place in the slide mailer marked "Perineal/Anal." Tape closed on one side only and fill out the label on mailer indicating perianal area.

14. Evidence Collection: Vulvar/Penile Swabs and Smears All items should be removed from the envelope. The swabs are moistened with one to two drops of water. Using both swabs simultaneously, with a rolling motion carefully swab the external genitalia, including along the folds between the labia majora and labia minora in the female patient. For male patients, swab the penis and scrotum. Prepare one smear on the slide provided and allow to air dry. Do not discard either swab, allow both to air dry. When dry, the swabs are placed in the box marked "Vulvar/Penile". When the slide is dry, it is placed in the slide mailer marked "Vulvar/Penile" and taped closed, on one side only. The label on the mailer is filled out. The mailer and the swab box are replaced in the envelope and sealed. All requested information on the envelope should be filled out, including possible type of secretion.

15. Evidence Collection: Vaginal Swabs and Smear Note: Do not stain or chemically fix smear. Do not moisten swabs prior to sample collection. Take special care not to contaminate the patient's vaginal area with any debris from the anal area. Remove all items from envelope. Using two swabs simultaneously, carefully swab the vaginal vault. Allow both swabs to air dry. When dry, place in swab box marked "Vaginal." Using two additional swabs, repeat the swabbing procedure of the vaginal vault. Prepare one smear on the slide provided and allow to AIR DRY. (Smear should be confined to the circle area on the slide.) DO NOT DISCARD ANY SWABS. When slide is dry, place in the slide mailer marked 'vaginal.' When second set of swabs are dry place in second swab box marked "Vaginal." Fill out all information on envelope; replace swab boxes and slide mailer into envelope and seal.

16. Evidence Collection Cervical Swabs and Smear Using two swabs simultaneously, carefully swab the cervix and cervical os. Allow both swabs to air dry. When dry, place in swab box marked "Cervical." Using two additional swabs, repeat the swabbing procedure of the cervix and os. Prepare one smear on the slide provided and allow to air dry. (Smear should be confined to the circle area on the slide.) When the slide is dry, place in the slide mailer marked "Cervical." Tape close on one side only and fill out label on mailer. When swabs are dry, place in swab box marked "Cervical." Fill out all information on envelope; replace swab boxes and slide mailer into envelope and seal.

Results and Discussion:

DNA from different biological samples was isolated by various isolation methods, amplified

amylogenic gene by PCR and separated on agarose gel electrophoresis. Since 2000, the majority of police forensic units and DNA laboratories in Switzerland have been using Prionics cotton swabs moistened with sterile water to collect biological traces (blood, sperm, saliva, touch DNA) at crime scenes or in the lab. Over the last decades, sampling procedures (single or double swabs) and extraction processes have been progressing, increasing the sensitivity of DNA analysis and allowing the consideration of traces with very small amounts of DNA. As a result, the types of collected specimens changed: the last five years, touch DNA accounted for at least 85% of the traces submitted to the forensic

genetics laboratory of Lausanne, Switzerland. In parallel, probably because of the many hits and operational successes achieved using Prionics swabs over the years, the use of this evidence collection kit was not questioned by practitioners. This was despite studies indicating that cotton swabs could trap some of the biological material collected or could interact with the DNA extraction process, resulting in a loss of material for the DNA analysis[12,16,17].

In addition, published research has shown different DNA yield because of swab models variable performance[11]. We then ask ourselves whether or not the swab in use was the best. To our knowledge, no published study has examined the selection ofa proper device for improving the collection and preservation of touch DNA in real operational conditions. This may be because of the complexnature of touch DNA, which consists mostly of sloughed, enucleated keratinocytes[18,19] and extracellular[20], partially degraded DNA derived from apoptotic epithelial cells, sebaceous[21] or sweat glands[22]. For this reason, it is complicated to identify which of the followingvariables (or their combinations) have a significant influence on DNA collection[1,16]: The swab head size, the layout and type offibres, the static electricity of a dry swab, the use of a solvent to moistenthe swab and consequently the substrate, the operator or the drying system. Since touch DNA specimens often contain low amounts of DNA, efficient preservation is essential. The institutions collaborating on this study routinely store DNA samples at room temperature (RT), protected from light. RT storage is convenient because it does not require cooling systems such as freezers or cold rooms, and the temperature is easily maintained when samples are transported. However, RT storage requires the swab to be dry to avoid DNA degradation. Leaving the packaging open until the swab is dry could be a solution, but this requires wait of several hours[15] and the risk of mix-up and pollution is non-negligible when several specimens are processed together. Drying systems have been designed that allow the device to be closed immediately upon collection. DNA stability data, according to the characteristics of the packaging of the swab, are available [13-15]. But it is difficult to compare the different studies because no consensus exists among them regarding the measurement of DNA degradation. Some authors simply looked at the evolution of DNA concentration[2,13], while others monitored the evolution of the proportion of alleles detected. Recently, several DNA quantification's kits have included degradation indexes (DI). However, the size of the DNA fragments targeted as well as the calculation of DI differs between kits[23].

Conclusion:

In our study, we extracted DNA from different samples and amplified amylogenic gene to

Identify gender for DNA typing, simultaneous performed RFLP and VNTR are the traditional genetic markers as well.

References:

1. R.A.H. van Oorschot, B. Szkuta, G.E. Meakin, B. Kokshoorn, M. Goray, DNA transfer in forensic science: a review, Forensic Sci. Int.: Genet. (2018).
2. H. Dong, J. Wang, T. Zhang, J.-y. Ge, Y.-q. Dong, Q.-f. Sun, C. Liu, C.-x. Li, Comparison of preprocessing methods and storage times for touch DNA samples, Croat. Med. J. 58 (1) (2017) 4–13.
3. I.A. Kirgiz, C. Calloway, Increased recovery of touch DNA evidence using FTA paper compared to conventional collection methods, J. Forensic Legal Med. 47 (2017)
9–15.
4. M. Matte, L. Williams, R. Frappier, J. Newman, Prevalence and persistence of foreign DNA beneath fingernails, Forensic Sci. Int.: Genet. 6 (2) (2012) 236–243.
5. S. Hess, C. Haas, Recovery of trace DNA on clothing: a comparison of mini-tape

lifting and three other forensic evidence collection techniques, J. Forensic Sci. 62
6. (2017) 187–191.
7. S.L. Stouder, K.J. Reubush, D.L. Hobson, J.L. Smith, Trace evidence scrapings: a valuable source of DNA? Forensic Sci. Commun. 3 (4) (2001).
8. D.T. Plaza, J.L. Mealy, J.N. Lane, M.N. Parsons, A.S. Bathrick, D.P. Slack, Nondestructive biological evidence collection with alternative swabs and adhesive lifters, J. Forensic Sci. 61 (2) (2016) 485–488.
9. B. Stoop, P.M. Defaux, S. Utz, M. Zieger, Touch DNA sampling with scenesafe fast™ minitapes, Legal Med. 29 (2017) 68–71.
10. T.J. Verdon, R.J. Mitchell, R.A.H. van Oorschot, Evaluation of tapelifting as a collection method for touch DNA, Forensic Sci. Int.: Genet. 8 (1) (2014) 179–186.
11. T. Vickar, K. Bache, B. Daniel, N. Frascione, The use of the m-vac® wet-vacuum system as a method for DNA recovery, Sci. Just. (2018).
12. T.J. Verdon, R.J. Mitchell, R.A.H. van Oorschot, Swabs as DNA collection devices for sampling different biological materials from different substrates, J. Forensic Sci. 59 (4) (2014) 1080–1089.
13. R.J. Brownlow, K.E. Dagnall, C.E. Ames, A comparison of DNA collection and retrieval from two swab types (cotton and nylon flocked swab) when processed using three qiagen extraction methods, J. Forensic Sci. 57 (3) (2012) 713–717.
14. S.K. Mawlood, M. Alrowaithi, N. Watson, Advantage of forensiX swabs in retrieving and preserving biological fluids, J. Forensic Sci. 60 (3) (2015) 686–689.
15. D. Aloraer, N.H. Hassan, B. Albarzinji, W. Goodwin, Collection protocols for the recovery of biological samples, Forensic Sci. Int.: Genet. Suppl. Ser. 5 (2015) e207–e209.
16. A.M. Garvin, R. Holzinger, F. Berner, W. Krebs, B. Hostettler, E. Lardi, C. Hertli, R. Quartermaine, C. Stamm, The forensiX evidence collection tube and its impact on DNA preservation and recovery, BioMed Res. Int. (2013).
17. B.B. Bruijns, R.M. Tiggelaar, H. Gardeniers, The extraction and recovery efficiency of pure DNA for different types of swabs, J. Forensic Sci. (2018).
18. M.S. Adamowicz, D.M. Stasulli, E.M. Sobestanovich, T.W. Bille, Evaluation of methods to improve the extraction and recovery of DNA from cotton swabs for forensic analysis, PLOS ONE 9 (12) (2014) e116351.
19. F. Alessandrini, M. Cecati, M. Pesaresi, C. Turchi, F. Carle, A. Tagliabracci, Fingerprints as evidence for a genetic profile: morphological study on fingerprints and analysis of exogenous and individual factors affecting DNA typing, J. Forensic Sci. 48 (3) (2003) 586–592.
20. T. Kita, H. Yamaguchi, M. Yokoyama, T. Tanaka, N. Tanaka, Morphological study of fragmented DNA on touched objects, Forensic Sci. Int.: Genet. 3 (1) (2008) 32–36.
21. C.E. Stanciu, M.K. Philpott, Y.J. Kwon, E.E. Bustamante, C.J. Ehrhardt, Optical characterization of epidermal cells and their relationship to DNA recovery from touch samples, F1000Research 4 (2015).
22. S. Zoppis, B. Muciaccia, A. D'Alessio, E. Ziparo, C. Vecchiotti, A. Filippini, DNA fingerprinting secondary transfer from different skin areas: morphological and genetic studies, Forensic Sci. Int.: Genet. 11 (2014) 137–143.
23. I. Quinones, B. Daniel, Cell free DNA as a component of forensic evidence recovered bfrom touched surfaces, Forensic Sci. Int.: Genet. 6 (1) (2012) 26–30.
24. A.S. Holmes, R. Houston, K. Elwick, D. Gangitano, S. Hughes-Stamm, Evaluation

of four commercial quantitative real-time PCR kits with inhibited and degraded samples, Int. J. Legal Med. 132 (3) (2018) 691–701.