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Collection and Preservation of DNA Evidence

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Abstract:

As the justice system or courts have more relay on DNA evidence in the last few years, the early steps in the examination of DNA evidence played a major role in the investigation. There is a need for proper collection and preservation of DNA evidence such as in sexual assault cases. This evidence played an important role in the personal identification of the victim and perpetrator or suspect. The importance of evidence preservation and collection is often revealed many difficult court challenges. In the identification, the forensic scientist tries to establish the link between victims, perpetrators with the scene of the crime. Now, to narrow down the aspect for identity, DNA evidence needs a proper collection and preservation because from this evidence we can extract a lot of essential information that helps in solving crimes and also provide a lead in case findings. This paper focuses on the techniques and methods to collect DNA traces. There is not so much research available on, but some studies reveal information and played a weighty role in the field of forensic science. This paper review those studies which give efforts in the collection and preservation of DNA evidence.

Keywords: *DNA Evidence, Collection, Preservation, Scene of Crime*

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Introduction

The DNA specimen plays a very important role in cases such as sexual assault, homicide, mass disaster, missing person identification, etc. Though, the achievement for a forensic laboratory examiner is depended on the condition of the evidence, if the DNA evidence is in a good condition then the maximum chances of a successful DNA profiling takes place. But if the collection and preservation of the evidence are not in an appropriate way then the DNA evidence might be able to give better results. All the biological evidence is at a risk of deterioration which results in microbial growth and this occurs due to environmental conditions. So, careful storage, collection, and preservation are important to obtain useful information for DNA analysis. A standard operating procedure is required for DNA collection and preservation in several types of the scene of crime and these procedures should be followed by medical doctors and investigation officers in the course of a criminal investigation. The DNA material is generally extracted from the biological samples. The biological samples from which DNA material is extracted and analyzed are such as blood and bloodstains, tissues and cells, hair with follicles, semen and seminal stains, bones and organs, saliva, etc. In case of bite marks the saliva is present on the person's clothing or skin. Blood, saliva, hair, sweat, vaginal fluid, and semen can be found on the pillow, bed cover, blanket, etc. in rape cases. In the crime scene investigation, DNA evidence plays a very important role, it helps in connecting the victim and perpetrator with the crime scene and helps in legal proceedings. And it also helps in the reconstruction of the crime scene and supports the statement given by perpetrators or suspects, victims, and eyewitnesses. The collection of evidence should take place step by step by the field investigator at the scene of the crime **(Lee & Pagliaro, 2013).**

The priorities of an investigator are to discovering the evidence, recognizing the evidence, examining the evidence, collecting the evidence, recording the evidence, identifying the evidence, and packaging and storing of the evidence, present the evidence in the court of law. To avoid the contamination proper handling of the evidence should take place at the crime scene investigation. The main purpose of the DNA evidence is to provide useful information that helps in connecting the perpetrator or suspect and victim with the scene of crime. Every scene of crime is unique. There is a need for proper marking, sealing, and packaging of evidence at the time of collection of evidence. After that send the evidence to the forensic science laboratory. The work of a forensic scientist starts from the scene of crime with evidence recognition and recovery. Sometimes the evidence left by the suspect at the scene of crime. After the collection of the evidence, they have to be properly analyzed in the laboratories. DNA evidence also helps in revealing the information related to corpus delicti, modus operandi, connecting or linking the perpetrator with the victim and weapon, helps in disproving or supporting the testimony given by the witness, helps in a personal identification of the suspect, proving a lead in the investigation. Blood is an important piece of evidence that is found on the scene of crime and it can be found on surfaces such as vehicle, weapon, soil, cloth, dead body, windows, wall, etc. If blood is found in the form of liquid at the scene of crime, then with the help of dropper collect the blood and stored in plastic or glass bottle after adding the suitable anticoagulant i.e. EDTA. And stored the blood evidence in dark and cool places because it gets destroyed in heat or when directly exposed to light. The semen preservation is always taking place after drying the semen stain completely. In case if semen stain is wet the chances of bacterial growth are possible and due to the protein present in semen, the stage of putrefaction may also occur. The semen preservation is always taking place in airbag, not in a plastic bag or airtight bag. If stain was found on a small article, preserved the entire article and send the sample in a forensic science laboratory. If semen stain is present on an immovable object, then with the help of a scalpel or sharp knife scratch the semen stain and packaged in a clean bottle of glass. A clean plastic tube or bag is also used in the preservation when a semen stain is present on the public hair. When the semen stain is present on any part of the body than with the help of cotton swab and saline water the stain can be collected. Do not touch the sample with bare hands because it results in contamination of the sample or sometimes it can have destroyed the evidence **(https://www.epgp.inflibnet.ac.in)**.

In biological samples, DNA played a vital role in acute sexual assault (ASA) cases which help in establishing the incidence of sexual interaction and also helps in the identification of the suspect. There are the techniques which are used to collect the DNA evidence,

One Swab – It is a quick technique but this technique does not give a guarantee in collecting the whole evidence for analysis in the laboratory. It is mainly used when the evidence is present in limited quantity

Two Swab – This technique is applied when there is abundant biological sample is present such as in cases where direct ejaculation was found in the vaginal cavity and this technique is only applicable to post pubertal victims. In this technique, the specimen is quickly collected and permits the usage of the second swab for counterproof.

Two Swabs Successively – This is also known as the double swab technique, it is the application of two successive swabs, and the first one is the wet whose target is to gather the evidence in the majority and the second one is a dry swab. This method has aimed to collect evidence in an abundant amount. It is not a rapid technique and there is no such guarantee of two swabs equality, the second swab can have evidence in a lower concentration. After having limitations, this technique is widely used for the purpose of the collection of numerous types of biological specimens **(Magalhães *et al.*, 2015)**.

To get the maximum information about the DNA profile from the biological samples collected from the scene of the crime, use a device that gives more significant results. This is vital to preserving from degradation and pollutants to maintain the integrity of the biological sample which helps in DNA analysis. So to make a successful DNA profile, the sample is not relaid completely on the laboratory examination processes but also depends on the sampling methods applied by the investigator at the scene of crime. Several types of collection methods are available such as FTA paper scraping, cutting method, scraping the surface with the help of a wooden applicator stick, taping, dry or wet, double or single swabbing, vacuum sampling. Swabbing is the maximum used versatile method. It is helpful in the collection of DNA samples which is used by both the forensic laboratory examiner and crime scene investigator. So, as a result, there is an increase in the swab type's methods, they are available in the markets. There are several studies conducted on the swabs and the swabbing conditions and questions are always arising on the institutions that the swabs methods are still suitable, whether they are giving good scientific results or not. There are some swabs that are used in the collection of DNA traces from different items. The swabs such as Puritan FAB-MINI-AP, COPAN 4N6FLOQ Swabs (Genetic variety), and Sarstedt Forensic Swab are used for the purpose of DNA traces collection **(Comte *et al.*, 2019)**.

Review of Literature

Lee and Ladd (2001) concluded that the application of DNA technology for criminal identification has increased in the past few years. DNA analysis has played an important role in both defense and prosecution. All over the world, DNA as evidence helps in linkage leading into the disclosure of several information. Still, the evidence DNA is not properly collected, recognized, documented, and preserved resulting in unable to find out the criminal.

Cătălin, Andrei, and Mitraşca (2011) proposed that the beginning of a new phase has arrived in law enforcement in the form of DNA research and testing. The authorized persons who visit the scene of crime have to be fully aware at the time of evidence collection. The highly fragile evidence is to be collected first. The evidence like DNA samples attains a full forensic value at the time of collection from suspects and victims. The performance of DNA samples is relying on the fact that how the DNA evidence was collected and preserved from the scene of crime at the time of the investigation. Hence, the points that are crucial in DNA analysis are how the DNA evidence was collected and packaged, what were the techniques used at the time of collection, how they were documented, how they were preserved.

Alex M. Garvin *et al*. (2013) concluded that in DNA preservation, the tools used in DNA sampling, having quick-drying properties show a significant result. And these tools are probably rising the amount of DNA recovered from the biological specimens composed on the swab.

Lee and Pagliaro (2013) studied that the detectives, crime scene investigators, police officers, or evidence technicians are the ones who are responsible for searching the evidence at the scene of crime. The investigating officers and laboratory examiners have a huge role in forensic analysis of physical evidence which helps in obtaining the data and which further gives aid in the justice system.

Palmbach *et al.* (2014) studied that in sexual exploitation cases DNA evidence provide valuable data. Rapid DNA analysis holds numerous key advantages that are helpful in the investigation. Rapid DNA analysis could take place at the place of sample collection, this will be minimizing the time taken in processing the sample.

Aloraer *et al.* (2015) proposed that in the process of collecting biological evidence like touch DNA, there is a necessity of further effort to be done in analyzing the efficiency of the detergent-based buffer. For better results, there is a need to collect the sample carefully from the scene of the crime because this is important in DNA recovery, and this gives a clear sign of best practices in handling the sample and send the collected samples to the laboratory.

Comte *et al*. (2019) concluded that the justice system and forensic scientists wish to attain the best results in DNA profiling. Today, a collective approach bringing the police and forensic scientists together. They both rely on the DNA laboratory. The traces of biological evidence were collected with the help of swab and stored the collected material at room temperature. With the help of touch DNA and various other substrates helps in DNA assess.

Discussion

The main aim of this review paper is to focus on the importance of the collection and preservation of DNA evidence from the crime scenes to the forensic laboratories. Although, there are methods and techniques used by the investigators for the collection and preservation of DNA evidence at the scene of crime. But the collection and preservation are not up to the mark in case of DNA material from biological samples. In some cases, the investigator lacks knowledge while collecting the DNA evidence, like mostly seen in blood collection and preservation. Hence, how the DNA evidence is collected and packaged, what are the techniques used at the time of collection, how they are documented, how they are preserved played a vital role at the scene of crime. Many well-known investigations like J.B. Ramsey and O.J. Simpson, tells the importance of the scene of crime. In the case of a blood sample, if the evidence is not properly collected and packaged resulting in contamination of evidence and later it will not fulfill the scientific and legal requirements for admissibility in the court of justice. As a comparative study conducted by **J. Comte *et al.*, (2019)** on some swabs such as Puritan FAB-MINI-AP, COPAN 4N6FLOQ Swabs (Genetic variety) and Sarstedt Forensic Swab and in which they concluded that COPAN 4N6FLOQ Swabs give the more significant results as compared to other swabs but on some items, it did not show a fruitful result. As a comparative study conducted by **Alex M. Garvin *et al.*, (2013)** with forensicX collection evidence tube and Sarstedt Forensic swab on saliva in which they observed that the DNA yield 95% with forensicX evidence collection tube and with Sarstedt Forensic swab 12% DNA yield takes place.

Conclusion

After studying the various research articles, this review paper concluded that the collection and preservation of biological samples played an important role in the extraction of DNA from the evidence such as bloodstains, seminal fluid, etc. But due to lack of knowledge, the investigators do mistakes in the collection and preservation of DNA evidence mostly seen in the case of wet blood. They have to be fully aware of the scene of crime. While examining the DNA samples, the result will depend very much on the quality and quantity of specimens collected. The criminal justice system and forensic scientists demand to attain the finest performance in DNA profiling. Thus, there is a necessity of selecting the finest device and methods which help in the collection of DNA traces and which shows a more significant result.

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