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Forensic science application: An effective tool of criminal investigations

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ABSTRACT

One of the most important inventions and development in the history of the human race is forensic science. Without having knowledge of forensic science, there would be a great negative effect on society as well as the judicial system. In the contemporary era, forensic science play a very important role in solving the crime problem. It provides better opportunities to the judicial system for solving the crime and in detection the criminal. The present judicial system of India comprise various modes of techniques including DNA Profiling, Brain-Fingerprinting, Narco-Analysis, Polygraph, DNA Fingerprinting, forensic DNA etc., which are proving very helpful in solving the crime problem. At present courts are taking these techniques in to consideration while delivering judgments.

1. Introduction

The Forensic Evidence, which is gaining lot of trust these days in the crime investigation, has been regarded as substantial in any criminal matter and from the beginning to end of investigation, and undoubtedly, forensics without any shadow of doubt plays an important part. The crime scene is a place where an offence happens in reality, thus, it may be the source of vital clues for any crime investigation, and if Investigating Officer is vigilant enough, he can have numerous evidence by using scientific techniques and methods. Sometimes the crime scene has been reenacted for the purpose of better understanding of crime scene.

2. Significance of Crime Scene

The crime scene is a place of occurrence of crime where the criminal activity has been done and all the physical clues and evidences are to be examined by a team of forensics. It is a place where criminals exchange their traces, according the Principle of Exchange as given by Dr. Edmond Locard, like fingerprints, footprints, saliva, and other biological material etc. The crime scene is of utmost importance as it may provide vital information which establishes many useful links to the crime. Some of such factors are as followings:

1. Corpus deliciti.
2. Reconstruct the crime scene.
3. Link between victim and accused.
4. Modus operandi and pattern of events.
5. Evidences found at crime scene.
6. Find out the weapon of crime.

Coming on Corpus delicitiit has origin from Latin words, one is “Corpus” which means body, and other is “deliciti” means crime, thus, on combination of both it means “Body of Crime”(Aiyar P. Ramnath, 2005).[1] The crime scene is searched and examined by police and forensic authorities, which in other words known as crime investigation department and forensic experts. Investigation of crime is conducted wit the motive of finding out the reality of act which in general language referred as crime, and intention

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to find out the culprit by gathering sufficient evidence which may be enough to convince the court in order to ensure the conviction. Police conducts investigation with attempt to establish the crime scene dimensions with necessary precautions and safety so that no tampering of evidences should happen. The initial stage of investigation at a crime scene must be done as carefully as the evidence found at the crime scene is the only means to convince the court about the crime and the culprit behind it. The crime scene, a matter of fact, can be categorized in two areas;

1. Indoor crime scene
2. Outdoor crime scene

Every crime scene, has its own unique characteristics which leave some specific clues where different approaches of investigation may be employed. There is only one chance, for police and forensic experts, available to examine the crime scene if any negligence occurred or because of climate like rain or storm, natural factors may tarnish the value of material lying there. Any fault, if any, is done on the part of any investigating authorities the whole case will turn around which may lead to the possibility that the culprit would never be found and the case will always be unsolved. It may also, in many cases, lead to punish the innocent person in case investigation done in improper manner.

3. Objectives of Forensic Investigation

The application of Forensic Science in the criminal investigation has, these days, acquired very special place as without its help the criminal investigation has gone nowhere in majority of the cases, as criminals have become advanced and using modern scientific methods in commission of crimes. It is the responsibility and duty of the forensic scientist to collect the samples very carefully and examine it correctly. The total conviction is based on such investigation which can be confirmed only after due diligence of forensic scientist. The application of Forensic Science in the investigation of crime can be effective only if the investigating officer knows (Ted Voske and Ashley F Emery, 2015):[2]

1. The nature of physical evidence to be collected.
2. Where it is found?
3. How it is collected and packed?
4. What standard samples for comparison purposes are necessary?
5. How much sample is required?
6. How the sampling is done?
7. How the evidence will link the crime with the criminal and to what extend his labors will be rewarded by the laboratory results?

This knowledge is useful if the investigating officer is given a thorough consideration to the all aspects of crime while conducting the investigation and for this purpose, that officer needs both theoretical and practical training which is essential for every Investigating Officer. Ignorance about the value of evidence sometimes obviously cause a lot of disappointment to an investigating officer. For example, a simple evaluation of hair may not lead to any positive identification of the source of hair, however, a deep analysis of every aspect of the same hair may give a good clue about some fact related to the crime. As the culprits these days become that much advanced it is not possible without proper training for an Investigating Officer at the present time, to unearth the mystery of crime as offenders are also using the scientific techniques to evade the law and law enforcement. Not only this, as it is the era of human rights and respect of fundamental liberties, it is sine qua non for every police officer to be aware about the limitations (Ted Voske and Ashley F Emer, (2015).[2]

4. Different Fields of Forensic Science

The different fields of forensic science which helps in the criminal investigation as follows:

4.1. Serology

Forensic serology, in terms law and law enforcement, is a branch of forensic science dealing with identification and characterization of biological, evidentiary samples- such as blood semen, saliva, sweat, breast milk and any other bodily fluids. However, from the biological perspective, it is the component of forensic biology that deals with the examination and identification of biological evidence (Li, Richard., 2015).[3] At the crime scene there may have different types of samples available, helpful to recognize the culprit or weapon used in the crime if a proper analysisdone. For example, the body fluids, semen, blood and etc. it helps to establish the conclusive evidences in the court. By preserving these samples carefully, the crime scene can be reconstructed properly for better understanding of the crime.

4.2. Ballistics

Forensic ballistics is a branch of forensic science which deals the examination of bullets which help to identify the firearms. A ballistic expert by examining the weapon can found out the type of firearm, identify the firearm, range of firearm and its effects. It plays very important role in solving the shooting cases and helps to answer the questions like the injury caused by weapon is justified or not, what kind of weapon fired it, what was the possible range of the weapon and who was the shooter. In forensic science, the study of ballistics is the study of motion, dynamics, angular movement, and effects of projectile units (bullets, missiles, and bombs).[4]

4.3. Fingerprint

Fingerprints are very unique in nature and as this fact is scientifically established that the fingerprints of two people are not same even in twins, and finger print of each person has its own individuality and also that it is permanent, universal, imitable and classifiable. The fingerprints are commonly used to solve the cases. Forensic fingerprint experts collect the samples very carefully as the latent fingerprints are invisible with naked eye that's why they use powder to discover it and collect is so carefully to examine it further.[4] Now, with the help of digital forensic it became very easy to match the fingerprint via database created digitally of all the criminals. It helps to connect a person to the crime scene by tracking the record of the criminal.

The forensic document examination deals with the authenticity of the document to determine its originality. The documents are examined for the purpose of providing evidence in the court. The experts reveal the ink, paper, stamps, writing tools and the other elements used in making of that document by analysing the documents invisible impressions. The basic element of document while analysing it focuses on the impressions of handwriting. The process of forensic handwriting involves its characteristics, whether it is normal writing, letter formation, the quality of line formation, the pressure writer imposes, the shading, direction of the slant and strokes of pen, speed, spacing, imitation and so other elements.[5] It takes a lot to examine such handwriting and also experts can by examining the handwriting can tell us about the writers age, habits and other characteristics as well.

In case of Rajeshbhai Mujlibhai Patel and Ors v State of Gujarat and Anr.[6] forgery, hand writing expert opined that signature in all receipts issued by the accused for payment of amount are not matching with the sample signatures of the accused and, thus, based upon his sole opinion a FIR was registered against the accused and, in retaliation accused filed application for quashing of FIR. It was held by the supreme court that under section 45 of Indian Evidence Act, the opinion of handwriting expert is relevant but is not conclusive evidence.

In Ram Gopal v CBI, Dehradun,[7] the employees of bank were charged with falsification of accounts, cheating forgery and criminal conspiracy. In this case, it was found that writing on receipt of passbook and cheque book from bank records and signatures on the cheques presented to withdraw cash from the fictitious account are in the handwriting of accused persons impersonating fictitious account holder. Prosecution relied upon the report of handwriting expert verifying the aforementioned fact. His report was not challenged by the accused. The Supreme Court held that the conspiracy on the part of the accused person is established.

In case of Murari Lal v State of MP[8] the Supreme Court observed that there is no rule of law nor any rule of prudence which has crystallized in to a rule of law that opinion evidence of a handwriting expert must never be acted upon, unless substantially corroborated.

In Smt Rashmita Vishikeshan Patel v Vivekanand Motilal Patel,[9] it was held by the court that it is not necessary to examine the handwriting of expert in all cases and his opinion with sufficient corroboration can be relied upon in the view of the provisions contained in section 45 and section 73 of Indian Evidence Act.

4.4. DNA profiling

The full form of DNA is Deoxyribose Nucleic Acid which contains the genetic information of a human being, that is another sense, also called "Genetic Blueprint". The Forensic DNA Analysis has been done by collecting the samples by using the disposable gloves and instruments, by avoiding the touch in the area of DNA, by avoiding talking, sneezing, eating and coughing around the evidence as it will contaminate the DNA, while collecting the sample avoid touching anything other than the evidence, also air dry the evidence before packing it and preserve the evidence carefully. DNA Profiling is a forensic technique which helps in criminal investigation by comparing the DNA evidences to the criminal suspects. DNA can be found out from any biological substance like hair, saliva, semen, blood and other elements.

In case of Patangi Balarama Venkata Ganesh v state of Andhra Pradesh,[10] the Supreme Court explained the importance of DNA profiling in the following words-

"Deoxyribonucleic acid, which is found in the chromosomes of the cell of living beings is the blueprint of an individual. DNA decides the characteristics of a person such as thecolour of the skin, type of hair, nails and so on. Using, this genetic fingerprinting, identification of an individual is done like in the traditional method of identifying fingerprint of offenders. The identification is hundred percent precise, expert opinion."

Mukesh v. State (NCT of Delhi),[11] in this case it was held that the evidence of expert regarding DNA is admissible in evidence in term of section 45 of the Evidence Act, 1872.

Santosh Kumar Singh Malik v. State of Haryana,[12] in this case the young girl was murdered and raped. The High Court relied upon the DNA reports, which was rejected by Trail Court. Later on Supreme Court also approved the same and held that the trial court was not justified in rejecting the DNA report, as nothing adverse could be pointed out against the two expert who has submitted it. DNA report as being significantly accurate and is an exact science, said, the apex court.

In Nandlal Wasudeo Badwaik v. Lata Nandlal Badwaik,[13] the appellant, the father of the child born to his wife, questioned the paternity of the child on the ground that his wife did not stay with him for the last two years. The court directed for DNA test. The DNA result

opined that the appellant was not the biological father of the child. The Supreme Court held that the husband's plea that he had no access to the wife when the child was begotten stands proved by the DNA test report and in the face of it, the court can not compel the father/ appellant to bear the fatherhood of the child when the scientific reports prove to the contrary. But the Supreme Court also observed that, we are conscious that an innocent child may not be basterdised as the marriage between her mother and father was subsisting at the time of her birth, but in view of DNA test reports what we have observed above, we can not forestall the consequence. It is denying the truth. Truth must triumph is the hallmark of justice.

Rajendra PralhadraoWasnic v State of Maharashtra,[14] it is true that the matching of DNA sample is emerging as a vital tool for linking suspects to the specific criminal acts. But where the sample taken from the body of the accused and sent for DNA profiling, however, the result of DNA was not produced before the trial court. The Supreme Court held that there is absolutely no explanation for not presenting the DNA report in the trial court from the prosecution side and in the absence of any justification for not producing the DNA evidence it would be dangerous on facts of the case to, uphold the sentence of death on the accused person.

5. Narco Analysis, Brain Mapping and Polygraph

The term Narco-Analysis was coined by Horseley. It was first used in 1922 when Robert house, a Texas obstetrician used the drug scopolamine on two prisoners. This test is conducted by mixing 3 grams of Sodium Pentothal or Sodium Amytal dissolved in 3000 ml of distilled water.[15] It uses to lower down the inhibitions of a person in which he goes into sleep like state where it become impossible for him to lie. In this state he will freely share the needed information easily. With the help of expert, the investigating officers can find out the probative truth. According to the orders of court this test is to be video graphed and presented in court as evidence.

In case of Selvi v State of Karnataka,[16] it was held by the Supreme Court that there are limitations of Narco-Analysis test. It does not have an absolutely success rate and there is always the possibility that the subject will not reveal any relevant information.

Polygraph or lie detector test is an examination of a person's mind and body with the help of different sensors which are attached to the accused body with the polygraph machine. These sensors help to investigate the truth. This machine records every detail of a person like his blood pressure, pulse rate and muscle movements. The examiner in this test involves the criminal psychologist who prepare a questionnaire according to the requirements of the investigation.[17] The brain mapping test was developed by a neurologist named Dr. Lawrence A. Farewell and chief scientist wave science, IOWA. In this test, there are no questions asked. It will be examined by showing the different pictures and sounds to the accused. After watching and listing to those elements the sensors which are attached to the brain of accused start printing some figures which will help to examine the scenario at hand. This method is fully verified and patented.[17] It plays very important role in finding out the truth.

5.1. Odontology

The science of teeth is known as odontology. Odontologists examine the structure of teeth, how they grow, and the disorders that affect them. "Of or relating to legal issues," as the term "forensics" denotes. The application of an odontologist's work to the legal sphere, such as in criminal proceedings, is known as forensic odontology. Forensic odontology is a branch of forensic science which deals with the examination and evaluation of dental evidence present at the crime scene it can be used as evidence to present before the court. From the dental analysis various information can be gathered for example the age, gender, DNA etc. The role of forensic odontology in criminal investigation is to establish the identity of a person by examining the dentals sample present at the crime scene. It is the responsibility and duty of odonatologist to keep the accurate record of the dentals and provide the important information to concerned authorities.

5.2. Toxicology

Forensic toxicology is a branch of forensic science which is the study of adverse effects of drugs and chemicals on biological organisms. It also helps to examine the poisons and its effects on the human body. Its main aim is to find out that whether a person is died because of poison? It analyse the body fluids and organs of dead body to find out the truth behind sudden and unexpected death. It also deals with the effects of alcohol and drugs on human performance and behaviour. It helps in the investigations of improper driving, drug related crimes, sexual assault and etc.

The same techniques are used in criminal investigation analysis as they are in death investigation analysis, although specimens are usually acquired from living people. Blood and urine are the most common specimens, however oral fluid, hair, and other samples may also be used. With a conversion calculation, plasma and serum can be utilised instead of whole blood when samples are taken from a clinical setting. Forensic toxicologists are regularly requested to evaluate the timing and severity of impairment caused by various drug and alcohol usage patterns. The largest issue in this area is interpreting test results, which necessitates the use of knowledge from clinical and medical studies, as well as field experience, to provide an opinion on the effects of a medicine or combination of drugs on an individual at the time of a crime or accident. Specimens

with a shorter window of detection include blood, urine, breath, and oral fluid, whereas long-term detection can use alternative matrices like hair, nails, or sweat.[18]

5.3. Nano technology

Nano- forensics is a completely new area of forensic science associated with the development of Nano sensors, Nano technical methods for real-time crime scene investigation. Application of nanotechnology is likely to enhance the capacity to toxic materials, forensic evidence in tissue, materials and soil. It mainly deals with the identification, evaluation, investigation of crime and finding connection between pieces of evidences. It helps to detect the crime. It is most effectively used in the discipline of forensic toxicology for examination of different toxic materials from forensic evidences like hair, blood, saliva and others. Gold nanoparticles, silver nanoparticles and titanium oxide nanoparticles helps to enhance the detection limit. It is also used in DNA Analysis, Fingerprint Analysis, Explosives Detection and Ballistics forensics.

There are other fields of forensics are also available which helps in criminal investigation. For example, Digital Forensics, Psychiatry forensics etc.

5.4. The ear print analysis

This is currently proven to be an innovative approach in the field of forensic science. Every person's ear surface is unique according to this technique. When a person's ear is rubbed against a surface, the material on the ear's surface is left behind, generating a two-dimensional ear print. It is possible to determine who is the culprit by comparing the ear prints of two people who appear at the crime scene.

5.5. Video spectral comparator 2000

In the field of scientific investigation, this is a novel technique. It is the machine that allows forensic scientists and crime scene investigators to inspect a piece of paper and detect hidden or covered writing, determine the paper's quality and origins, and "lift" indented writing. VSC 2000 Video Spectrum Comparators is based on video spectral imaging analysis. A camera, specific light sources, and filters for the visible, UV, and near-IR ranges are used in this technique. The use of light sources with different frequencies in this technique allows for the inspection of the aspects of the document in question without causing any form of deconstruction and aids in the identification of the document preparation methods used: Indentions, deletions, and inks are all part of the typing process.[14]

6. Magnetic Fingerprinting and Automated Fingerprint Identification (AFIS)

The automated fingerprint identification system (AFIS) is a biometric identification method that employs digital technology to locate, store, and analyses fingerprint data. For the first time, the US Federal Bureau of Investigation employed this technique to solve a criminal case. As this nascent technique of forensic science evolved, it became much easier for investigative authorities such as police and forensic scientists to compare fingerprints found at a crime scene.[19]

7. Conclusion

In the end, we can say that science and technology has been making an inroad in every field of life and law field is no exception to it. However, scientific evidence does not get the clear cut confidence of courts in varius parts of the world. Yet, many fields of forensics like finger prints, DNA, Nano Technology have emerged as reliable factors in the eyes of the courts. Ear printing and Brain finger printing, are still developing and may in future be proved as very efficient in crime detection. Video Spectral Comparator is also very helpful in comparing data.

In future it would impossible to solve the crime and to find out the criminal without applying these techniques. Day by day the new technological developments are taking place. So there is need to apply to such techniques so that the society could be protected from commission of the crime and if crime commit by any person, he could be punished.

Even though these scientific techniques are proving very helpful asset to the society as well as criminal justice system but there are also some bad consequences of application of these techniques. Little bit temperament with the scientific evidence reverse the result of finding of the crime. By the present article the effort has been made to disclose the relevancy of the techniques of forensic science as well as their bad consequences if not conducted with care.

8. Conflicts of Interest

The authors have no conflict of interest to declare.

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