



# Sexual Offences: Recent Methods of Investigation

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## Abstract

A sexual offense is a crime of violence against a person's body that causes physical trauma, emotional distress, and suffering of victims. The investigation of sexual crimes necessitates the involvement of a multidisciplinary team of forensic experts who are dedicated to the discovery, recovery, packing, and analysis of evidence. During the crime scene investigation, identification and recovery of biological evidence are of prime importance, since it is often the only way to confirm sexual contact and the offender's identity. The investigator must be able to detect proof that would otherwise go overlooked using characteristic technology and techniques. Traditionally, forensic science laboratories use established procedures to classify biological evidence and molecular methods to produce DNA profiles grounded on amplification and DNA sequencing that are laborious and expensive and not provide significant information in DNA mixtures samples. However, now there is a series of a modern method of investigation which overcomes the disadvantages of traditional methods and is very useful to identify the sexual offender in forensic investigation. This chapter explained about the sexual offenses, traditional crime scene investigation, and the recent investigative techniques like DEPAarray for sexual offense evidence processing, bite mark utility, spermatozoa detection using ultrasound technique, and the forensic 3D/CAD supported photogrammetry approach which allows for a prevailing and reliable method of analyzing sexual offense data, allowing for unparalleled sensitivity and specificity while also removing the need for conventional human sperm confirmatory tests and qPCR-based DNA quantification.

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## 7.1 Introduction

### 7.1.1 Sexual Offences

When another person intentionally improperly interferes with your physical body, this is known as a sexual offense. In a sexual situation, an individual touches your private parts in any way, and/or by sexual activity, much of this is performed without consent or knowledge. Sexual abuse could also happen when an adult contacts a child under the age of 16 by phone calls, notes, or email, to communicate with the child and engage in sexual activity. Sexual grooming is another term for this [1].

Sexual assault (SA) is a crime of violence against a person's body resulting in physical trauma, mental anguish, and suffering for victims generating expenses for government-intended criminal investigation, medical care, and psychological attention. During the crime scene investigation, the identification and recovery of biological evidence (BE) are of utmost importance since sometimes these are the only way to prove sexual contact and the perpetrator's identity. With the help of specific technologies and techniques, scientific examiners must be able to find evidence that otherwise could go unnoticed [2].

Sex-related crimes are the most heinous and degrading of all the crimes. Children and women persist the most vulnerable group to this crime. The unprecedented increase in sexual harassment rates around the world is a major public health concern [3]. As per the National Crime Reports Bureau, a woman or a girl is raped by a man in every 15 min [4]. However, the majority of rape reports go unreported. The perpetrators were known to the victims in nearly 94% of the cases and mainly belong to family, acquaintances, live-in spouses, employers, or others, according to the data. In 2018, 33,356 rape incidents were registered, affecting 33,977 victims, for an average of 89 rape incidents per day, and in 2019, 88,477 crimes were registered under assault on women with the intent to outrage her modesty. Since the abuse or sexual crime was perpetrated by a victim's acquaintance or relative against women were labelled under acquaintance or relative, the incidents were not registered in order to protect the family's credibility. Most of the crimes committed against women go unrecorded because families are pressured not to report the incident, resulting in an increase in the silent crime rate of rape [5].

Sexual offences are classified into different categories such as natural offenses, unnatural offenses, sexual paraphilias, and sex-linked offenses. These categories are further classified as

1. Natural offenses—rape, incest, adultery
2. Sexual paraphilias—sadism, masochism, necrophilia, exhibitionism, undinism, fetishism, frotteurism, transvestism, masturbation, etc.

3. Unnatural offenses—bestiality, sodomy, tribadism
4. Sex-linked offenses—trafficking, stalking, sexual harassment, voyeurism, indecent assault [6]

Sexual crimes are a rising problem for police, the general public, and the community, and they impact the citizens at all levels. The investigation process entails a collaborative effort between police officers, the investigating team, the victim advocate, and the medical examiner. There are a series of phases, from interviewing the victim to gathering data, analyzing it, and writing a final report.

The crime rate is growing every day, and the number of sexual assaults is increasing as well. Following the commission of a crime, the investigative process is followed; however, the traditional investigation procedure needs to be updated with advanced techniques for a better investigation and outcome. Recent progress in this area, like other fields, is desperately required. Several new investigation techniques have been established such as the DEPArray™ system for sexual offense evidence processing, bite mark documentation, and analysis: the forensic 3D/CAD supported photogrammetry approach, spermatozoa detection using ultrasound technique, etc.

## 7.1.2 Natural Offences

### 7.1.2.1 Rape

Rape is classified as consensual sex or touch if it's without the suspected victim's permission, where the act includes violence, force, coercion, or fear of injury. This description now encompasses dissemination against both men and women and even incorporates other males and females. Penetration forms are oral, interactive, and anal. The National Crime Victimization Survey describes rape as the illegal penetration or attempt of the act by an individual against the victim's will, with the use or attempted use of force [7].

Rape requires physical aggression and psychological manipulation, and involuntary sexual intercourse means the offender's vaginal, anal, or oral penetration. Incidents involving penetration of a foreign substance like a bottle, victimization of male and female victims, and homosexual and heterosexual offense are often included in rape [8].

States vary in their legal definitions of rape; however, most states share commonalities about what distinguishes this conduct. Second, rape occurs when non-consensual contact or penetration occurs between the penis and the mouth, anus, or vulva. This may also mean that a finger, hand, or penetration of an unusual object may have non-consensual contact or penetration. Rape can occur in several ways, including attempted rape, sexual harassment, statutory rape, and date rape.

Attempted rape requires the physical attempt to commit a sexual encounter as well as verbal threats of rape [9].

Statutory rape refers to sexual intercourse or improper sexual intercourse. For an individual under the legal age of consent, usually between 14 and 17 years of age,

irrespective of whether or not a minor person has engaged in sexual intercourse with an adult knowingly, voluntarily, and with mutual agreement, and failed to cooperate with the state, charges against the adult can still be filed. When a public official, such as a highly regarded educator, priest, or concerned citizen, engages in sexual activity with any child under the age of 18, more laws and penalties are enforced. Date rape is another type of rape, which usually occurs among acquaintances. Date rape is considered a sexual attack by a person with whom the victim has a relationship, and as the relationship, the assault takes place [10].

As per section 375 of the Indian Penal Code, rape is defined as a man who, except in the case hereinafter exempted, has sexual intercourse with a woman under any of the following six descriptions:

1. Against her volition
2. Without her approval
3. With her consent, whether her consent was gained by placing her or another person in fear of death or hurt that she is interested in
4. When the man knows with her consent that he is not her husband and that her consent is given because she acknowledges that he is another man to whom she is legally married or believes herself to be
5. With her consent, when, at the time of giving such consent, she is unable to understand the essence and effects of that to which she gives consent because of unsoundness of mind or intoxication or administration by him directly or by another of any stupefying or unsafe substance
6. With or without her permission, when she is under the age of sixteen

Explanation: Penetration is necessary for the offense of rape to constitute the sexual intercourse required. Exception: a man's sexual intercourse with his own woman, a wife not under the age of fifteen, is not rape [11].

### **7.1.2.2 Incest**

Incest is a specific form of child sexual exploitation that is often serious implications for the infant, the abuser, and the family. The Webster Dictionary describes incest as "sexual intercourse between persons too closely related to marry legally." In the area of child sexuality, abuse refers more frequently to any sexual contact between a child and a close relative [12].

The most common type of child sexual exploitation is incest. Incest is described as any sexual contact between a child or a teen and a person who has intimately involved particularly stepparents and live-in spouses of parents, related or considered to be related. Many perpetrators are female; most perpetrators are male.

In most cases, it is the dad or the stepfather who misuses the kid. Incest likewise incorporates sexual action by kin, cousins, moms, uncles, aunties, or grandparents. Incest includes sexual activity that happens just a single time, just as a movement that happens throughout an all-inclusive timeframe, frequently quite a long while. Fondling, oral sex, anal sex, and intercourse are among the forms of sexual activity. The disintegration of loyalty within the family increases the mental harm associated

with sexual abuse. About 50% of women don't remember their adulterous experiences until something stimuli adult memory. Many women who still do recall may be saddened to learn that the crucial steps of understanding and exposing incest to others do not offer immediate relief from the burden of pain and issues left behind by the incest. It does not make the timidity go away to understand why one has always felt shy undressing in front of others. Similarly, resolving other concerns, such as rage and sorrow, while important to the work of incest, does not inherently contribute to the resolution of sexual issues [13].

### 7.1.2.3 Adultery

Adultery is an infringement upon the spouse's right over his better half. It is an offense against the sacredness of the marital home and an act performed by the male. It is an opponent of social and illegal agitation. The extent of the offense under the segment is restricted to infidelity submitted with a wedded lady, and the male guilty party alone has been made responsible to be rebuffed with detainment, which may broaden up to five years, or fine or with both. A woman's consent or willingness is no justification for the crime of adultery. Adultery, therefore, is a crime performed by a male against a husband concerning his wife. It is not committed by a person who has consensual sex with a single woman or a prostitute, or a widow, or even a married woman whose husband or wife consents to it [14].

Adultery is limited in scope as mentioned under Section 497 of the IPC, opposed to the violation of adultery as known in divorce proceedings. The crime was committed only by a male who had sexual intercourse with the wife of another man and without the latter's permission or connivance. Evidence of sexual activity, moreover, is an integral element of the crime, but clear evidence is rarely accessible and must be derived from the entirety of circumstances in most instances. A married woman whose husband consents or connives to the sexual relationship must be the perpetrator. This will not be a crime of adultery and, thus, will not be subjected to Section 497 IPC. In case of adultery, the offended person is the husband whose wife has consented to have sexual relations with an individual other than her spouse. Section 198(1) of the Code of Criminal Procedure, 1908, states that no person other than the wife's husband shall be found to have committed an offense of adultery under Section 497 or Section 498 of IPC, if, in the absence of the spouse, any person who, on behalf of the aggrieved husband, took care of the woman, with permission of the court, complains against the accused. However, the consenting woman (the aggrieved husband's wife) cannot be convicted in the event. Section 497 specifically states that a woman who is a party to the crime of adultery will not be charged as an abettor or co-accused because she is considered a victim by the statute and not a perpetrator of the offense. Although the Indian Penal Code (Amendment) Act 1972 was passed, it was suggested that this right imposed on women about an adultery offense should be scrapped given the transformation of Indian society and change in sociolegal as well as ethical standards with the advancement of the period and democratic response, but the proposal did not collect the requisite support and must be released [11].

### 7.1.3 Sexual Paraphilias

Sexual paraphilias is an emotional dysfunction in which a person is having repeated extreme sexual desire and fantasies and may also involve non-human objects.

Characteristic features of sexual paraphilias are as follows:

1. Periodic extreme sexual imagination, sexual desire
2. Behaviours involve non-human objects, oneself sufferings, and humiliations
3. Suffering and humiliations of oneself and one's partner
4. Recurrent desire for children and other nonconsenting individually

This behaviour and sexual desire are responsible for significant sufferings and deterioration in social, occupational, and other important settings. As per DSM-IV, there are eight different types of sexual paraphilic disorder like sadism, masochism, necrophilia, fetishism, exhibitionism, masturbation, frotteurism, and undinism [15].

#### 7.1.3.1 Sadism

Clinically sadism is characterized to experience pleasure from others people psychological and physical suffering. Sexual sadism paraphilic is mainly focused on getting sexual gratification by violently dominating and inflicting pain or by the act of cruelty on the opposite partner suffering including humiliations of the victims.

A few people with this paraphilia are annoyed by their perverted dreams, which might be summoned during sexual action yet not in any case followed up on; in such cases, the vicious dreams ordinarily include having unlimited oversight over the person in question, who is unnerved by expectation of the looming savage demonstration. Others follow up on the perverted sexual desires with a consenting accomplice who readily endures torment or embarrassment [16].

Some scholars propose that necrophilia and other posthumous practices are twisted in nature. The suggested standard, in accordance with Dietz et al., reconfirms that no conduct occurring after a casualty is oblivious or perished and meets the weight needed for the utilization of the descriptor perverted. If the victim suffered, whether the suffering was purposely induced, and if the suffering sexually attracted the offender are the key issues, and this is the reason neither sexual nor cruel acts performed on an unconscious or deceased casualty are essentially proof of sadism [17].

Typically, sadist persons are the men who are excited as much by the power and force as by the sexual demonstrations. They may likewise participate in unusual formal conduct and related to the sexual ensnarement of victim and might be sexually excited by the oblivious or dead body [18].

#### 7.1.3.2 Masochism

Masochism is a psychosexual condition in which the suffering inflicted on oneself achieves sexual relief. Masochism term gets from the name of Chevalier Leopold von Sacher-Masoch, an Austrian author who expounded broadly on the fulfilment he acquired by being beaten and oppressed [19]. It is purposeful interest in an action

that includes being embarrassed, beaten, bound, or in any case manhandled to encounter sexual excitement. Sexual masochism issue is sexual masochism that causes huge trouble or essentially weakens working. The disease of sexual masochism is sexual masochism that causes severe discomfort or seriously impairs functioning. The amount of pain involved will range from ceremonial humiliation with little abuse to extreme whipping or beating; the masochist normally maintains some control over the situation and, before being seriously hurt, can end the violent conduct. Although pain in certain individuals can induce a certain amount of sexual excitement, it becomes the primary end of sexual activity for the masochist [20].

Masochistic operations might be the liked or restrictive method of creating sexual excitement. Individuals may showcase their masochistic fantasies on themselves—for instance, by restricting themselves, penetrating their skin, applying electrical stuns, and burning oneself. They may also search out an accomplice who might be a sexual sadist and include the activities like leaping, blindfolded, hit, flogged, mortified by being peed or crapped on, compelled to dress in drag and part of a re-enacted DSM- 4 as a paraphilia; this scheme is not otherwise defined. It is a one form of sexual masochism disorder. Most persons who indulge in autoerotic asphyxiation are males, although this activity has also been recorded in teenagers, older adults, and women. The person engaged in autoerotic asphyxiation limits their breathing to improve their sexual experience at or near time of orgasm usually, or herself, by strangulation or suffocation, neck ligatures like scarves, underwear to choke themselves, plastic bags put over the head, suffocating masks, chest compression, and simultaneous masturbation. It is believed that the establishment of a hypoxic state increases orgasm and sexual gratification. Tragically, there is a slim line isolating hypoxic rapture from unconsciousness and death. Loss of consciousness can occur rapidly because, even before hypoxia and hypercarbia become important, obstruction of venous return from the brain impairs cerebral perfusion [21].

Individuals who asphyxiate themselves in such a way that if they lose consciousness, the ligature does not release may accidentally have permanent brain damage or death. Not surprisingly, that is, the most dangerous of autoerotic asphyxiation is considered practitioner's paraphilia [22].

### 7.1.3.3 Necrophilia

Necrophilia is a term derived from the Greek words philios which means appreciation for/affection and nekros meaning dead body. Necrophilia is also called as necrolagnia, necrocoitus, necrochlesis, and thanatophilia. It includes the sexual fascination in a dead body. Necrophilia refers to a recurrent sexual arousal or sexual contact with the deceased, associated with the dead. It could be seen alone or in conjunction with a variety of different paraphilias, including sadism, cannibalism, vampirism (the drinking of blood from an individual or creature), necrophagia (eating the substance of the dead), and necropedophilia (the sexual attraction to children's corpses) [23]. It has even been seen in wildlife creatures known as necrozoophilia. Very often, grave diggers and mortuary attendants were found rehearsing necrophilia. They participate in this action maybe in light of the fact

that of their depression, combined with simple admittance to corpses. It is likewise conceivable that they picked this career, since that they were necrophiles, which also permits them free and unhindered access to dead bodies. DSM-IV-TR does not assign necrophilia to any particular or special code. Instead, along with many other rare paraphilias, it is grouped under Code 302.9 [23, 24].

#### **7.1.3.4 Fetishism**

Fetishism is recurring, intense, explicitly sexual fantasies, sexual desires, or gratification including the utilization of fetish, for example, leather and rubber garments, women panties, stockings, bras, Boots, and shoes. This is called 'transvestic fetishism' when the fetishes are restricted to female clothing that the person uses to cross-dress. The sexual attraction to uniforms is a special kind of fetishism, even though it is hardly ever a clinical issue [25].

#### **7.1.3.5 Exhibitionism**

Exhibitionism is characterized by the individual having repetitive, exceptional, explicitly stimulating fantasies, or practices, including exposing one's private organs to unwilling audience. Exposing clearly a very persistent and incessant behaviour among these sexual offenders [26].

#### **7.1.3.6 Masturbation**

Masturbation is an effort to accomplish self-pleasuring by contacting, scouring your own body parts which lead to the erection and sexual arousal through genital organs stimulant physically by hand or mechanical incitement. It might include two people, which is known as mutual masturbation. It is common in both men and women. Male largely involve rubbing of penis against a bed or other objects and may use hollow articles like test tubes, bottles, and rubber, whereas females may rub the genitalia against a pillow or bed. They can also move fingers over clitoris or labia minora to stimulate sexual arousal. Sometimes, women can use wooden rods, glass tubes, bananas or insert fingers in to the vagina for experiencing sexual pleasure. Masturbation is not a sexual intercourse, but it is an offence when practiced openly.

#### **7.1.3.7 Frotteurism**

Frotteurism is derived from the French word "frotter," which means "friction." It is also known as "frottage." It is characterised as "a person who becomes sexually aroused by the act of rubbing up against a non-consenting person for sexual gratification". It is an atypical paraphilia and added in to DSM -III in 1980. It's a paraphilia that often coexists with other paraphilias including exhibitionism and voyeurism, all of which are courtship disorders. A frotteuristic act has legal consequences for the perpetrator, and victims report a variety of negative consequences as a result of victimization [27].

#### **7.1.3.8 Undinism**

Undinism is a paraphilia in which sexual excitement is associated with the sight or thought of urine or urination.



## 7.1.4 Unnatural Offenses

### 7.1.4.1 Sodomy

Noncoital carnal copulation is called sodomy. In history, literature, and law, the term is understood in many ways: (1) as indicating any homosexual activities among men, in contrast to the biblical tale of Sodom (2) as signifying anal penetration, (3) as associated with bestiality or zoophilia (i.e. sexual relations among animals and humans), and (4) covers a variety of other sexual behaviours, ranging from sexual intercourse with juveniles to oral-genital intercourse and adult-to-adult intercourse [28].

In some countries, sodomy is a felony and is rejected in many others as a sign of the disorder. Some criminal systems, even though the relationships are mutual as well as between lawfully consensual adults, include punishments as serious as life imprisonment for homosexual intercourse. As such, sodomy laws tend to extend even to married couples, simply outlawing several sexual contacts.

No such legislation is identified in the laws of Sweden, Switzerland, Denmark, Italy, and France. The Wolfenden Committee in England and the American Law Institute in the United States have suggested that criminal laws in this area be eliminated, except cases involving crime, child abuse, or public appeal to commercial defectors [29].

### 7.1.4.2 Tribadism

Tribadism is also known as lesbianism or sapphism. Female homosexuality in which females receive erotic desires from another woman by embracing, body touches or frictions of genital organs, etc. This form of action is part of India's LGBT rights, which were legalized by India's supreme court, claiming that homosexuality in ancient Indian and traditional codes was never unlawful or a federal crime but was criminalized by the British throughout colonial rule in India [29].

Tribadism is a type of non-penetrative sex in which a female rubs her vulva against the body of her partner for sexual arousal, particularly for sufficient clitoral stimulation. Tribbing, widely known for its scissoring role, is a form of non-penetrative sex.

That could include woman-to-woman genital contact or a woman rubbing her vulva against the thigh, chest, buttocks, arm, or other parts of her partner's body except for the mouth [30] [31]. Several sex positions, including the missionary position, are recorded [32].

Lesbian sex generally included social assumptions regarding the capacity of women to be penetrative sexual partners [30, 33]. Women suspected of having been penetrative during sexual activity were subject to mockery or punishment [30, 34]. The term applies to different types of exhibitionism without any derogatory connotations amongst women in modern times. Via the use of fingers, a dildo, or a double-penetration dildo, it can also include vaginal dissemination or apply to a masturbation method in which a female squeezes her vulva against an inanimate object such as a bolster to feel pleasure [35].

Section 377 IPC stated that whoever knowingly has lustful intercourse with any guy, female, or animal against the order of nature shall be punished with life imprisonment or imprisonment from either form for a period that may expand to 10 years and sentenced to fine. Penetration is appropriate to constitute the carnal intercourse required for the offense mentioned in this section [11].

## **7.1.5 Sex-Linked Offences**

### **7.1.5.1 Stalking**

Stalking is much more prevalent in today's scenario than any other form of sexual violence, and most of the time, it's gender-specific. It is a course of conduct that includes infliction of one individual by another individual through continual unsolicited intrusions/interventions and communications to a level that the individual fears for his/her protection [36, 37]. It includes actions such as following a person and visiting at home/office or business place. Frequent distressing phone calls or messages, sending written messages or objects, or destroying property of that person. In some instances, these courses of action may be accompanied by serious harmful threats and may or may not be the indication of any form of assault or homicide [38]. Stalking has arisen as a form of human behaviour which takes attention from the public, as well as attracting the interest of researchers among various mental health professional. The development of stalking as a major social issue has to lead to in its categorization, in much western law-making legislations, as a particular form of a criminal offense [39].

### **7.1.5.2 Voyeurism**

The definition of voyeurism has been changed many times; in many places, it has been described as a pathological indulgence in looking at some form of nudity as a form of sexual gratification despite normal sexual acts [40, 41]. In voyeurism, the gratification is observed without coming in sexual intimation with any individual who is being noted. It is a common form of paraphilia and is mostly seen among men. Voyeurism generally starts at the age of puberty and phase of adolescence and maybe initial stages of adulthood. Several degree of voyeurism is seen more among teenage boys and men but gradually increasingly between women. It is taken as normal behaviour in society if the mild form of voyeurism is seen when consenting adults are involved. Sexual content available on Internet freely is not considered a form of voyeurism because the element of voyeurism involves secret observation.

### **7.1.5.3 Sexual Harassment**

There was a time when the study of sexual assaults/harassment majorly focused on identifying its importance in being a social problem or not and sufficient of research for its prevalence; later on, due to increase in reported cases of sexual harassments, the study is shifted towards finding the causes and effects of it on individual and society.

In a legal point of view, sexual harassment falls under a type of sex discrimination that have two major forms of behaviour; first is *quid pro quo*, and the second one is hostile environment harassment. The former form of harassment includes sexual intimidations or bribing someone that is made a condition of employment or used for the basis of employment decisions. The hostile environment includes those behaviours like having comments, sexual jokes, and inappropriately touching that interfere with a person's ability in doing the job or that lead to a "stressful/unfavourable hostile or offensive working condition and intimidating environment".

There is significant variation in the approximate proportions of women reporting incidents of sexual assault. It has been observed that around 90% of women experience some form of sexual harassment at the workplace [42].

Sexual harassment severely affects the mental health of women and is a matter of concern because taking a woman as the object of sexual attention severely undermines her self-confidence and self-esteem as a potential worker. A profound aspect of this sexual harassment includes realizing women that they are not welcomed at the workplace and a not respectable member of workgroups, which hampers many career opportunities for them.

#### **7.1.5.4 Sex Trafficking**

Sex trafficking is a form of human trafficking, including sexual slavery, and is taken as a form of modern slavery for sexual exploitation. According to an International Labour Organization report of 2012, 20.9 million people were subjected to forced labour, with 22% (4.5 million) being victims of forced sexual exploitation. However, it is difficult for researchers to obtain precise, credible figures due to the hidden nature of sex trafficking. According to the ILO, the global economic profits share of sexual exploitation are projected to be \$99 billion [43–45].

A victim is coerced into a condition of reliance on their trafficker(s) in one of several ways and then exploited by the trafficker(s) to provide customers with sexual services [46]. Sex trafficking crimes may include acquisition, transport, and abuse [47]. This also comprises domestic minor sex trafficking (DMST), child sex tourism (CST), or any other forms of commercial sexual exploitation of children [46].

#### **7.1.5.5 Indecent Assault**

Indecent assault in many jurisdictions is an act of aggravated assault. It is defined as a crime of sex. Under Sections 14 and 15 of the Sexual Offences Act 1956, indecent assault was an offense in England and Wales. Under Section 3 of the Sexual Offences Act 2003, it was repealed and replaced by a related crime of sexual harassment. Any unwanted sexual activity or touching was identified as that which is against their will imposed upon individuals. The definition of indecency relies on dominant perceptions on what is improper conduct. This may involve actions such as pressuring others to watch masturbation or pornography. This is often linked to cases of sexual abuse, including, but not necessarily, forced oral sex.

Some of the forms of indecent assault widely used include—groping someone in an uncomfortable way to arouse some sexual desire, touching people or

inappropriately grinding them against their bodies, teasing others poorly, and shaming the other person's body

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## 7.2 Investigation in Sexual Offenses

Sexual offenses are a major growing concern for police, the public, and society, and at all levels, it affects the people. The investigation in case of sexual crimes is of at most importance. The primary sources of evidence and information are mainly gathered from the victim's body, the suspect and the scene of the crime, and also the witnesses. The investigating officer should carefully investigate the sources and also any other available source of information and evidence.

Before beginning to examine the crime scene, police should collect as much information about the type of crime scene: its surrounding, environment in order to avoid the degradation or deterioration of important and/or vulnerable evidence such as shoeprints, trace evidence, and so on. The main areas of inspection are the rugs, floor, bedding, toilet, and trash or dustbin where things such as condoms may be discarded by accused while the inspection could be also extended to the neighbourhood. For searching the evidences that indicate that sexual contact taken place, naked eyed observation is important, but using light sources for identification of biological evidences is important . Because of their properties, such as light absorption (blood) or fluorescence radiation, these components of biological evidence necessitate the use of forensic light sources for identification (semen, saliva, and urine). This is a simple, presumptive, and non-destructive examination.

These cases are more complex because of higher chances of contamination or degradation of evidence (like DNA, blood, hair, fibres). It depends on the case and type of sexual offense, and accordingly, evidence needs to be collected, in alcohol and drug-facilitated sexual assaults, rape cases, and unnatural sexual offenses like sodomy.

For proper investigation of sexual offenses, appropriate training, preparation, and establishment of jurisdictional policies. The examiners and other related healthcare professionals, 911 dispatchers, law enforcement officials, prosecutors, emergency medical technicians, advocates, and judges are given education and training on alcohol and drug-facilitated sexual assault, also on the management of these type of cases where sexual assault is suspected [48].

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## 7.3 Investigative Procedures

Officers and paramedics respond to sexual harassment calls in a variety of ways. Personnel in charge of communications must make every effort to keep the lines of communication accessible. Keep an open mind and don't pass judgment on the details obtained from the perpetrator or the party that reported the crime. Each victim is unique and, depending on his or her circumstances, will react differently.

Officers or communications staff responding to sexual harassment calls must make an attempt to have an open mind and refrain from interpreting the facts received from the witness or party reporting the crime. Based on his or her history, attitude, and the circumstances of the attack, each survivor will react differently. For example, the majority of sexual harassment victims are female, but if the caller is male, stereotypes should be avoided. Victims of drug-assisted sexual abuse, in particular, can experience blackouts, gaps in recollection, and overall confusion about occurring of assault.

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## **7.4 Response by Communications Personnel**

Communications staff should meet standard emergency response protocols when a caller reports a sexual assault. This involves gathering the basic details of the situation, looking for if the victim or any other person is in imminent danger situation and in need of immediate medical help, and also keep dispatching emergency medical assistance as required. If the call is about a current or recent crime, communications staff should collect information from the caller to help in locating and prosecuting the crime and apprehend the suspect.

When a sexual assault is reported by a caller, emergency response procedure should be followed. This comprises of explaining about the initial situation, understanding the seriousness of the situation, also looking for any danger or life-threatening condition victim may be in, or any requirement or emergency medical help needed. If call related to an ongoing or recent incident, communications officials should collect details from the complainant to aid in locating and detaining the suspect. Often, you should be able to determine if or not there is a connection between the victim and the perpetrator, whether there has been some previous history of abuse, and whether a weapon is involved. To minimize victim frustration, the personnel of communication response have to explain that the questions being asked will not hinder the arrival of an officer to the location of caller. The communication personnel have a duty to be on the call till the officer reaches to location. It becomes almost important in sexual assault cases to determine whether a victim has urinated, bathed, douched, or any such form of activity that potentially may damage probative evidence like hair, semen, and saliva. Precautions should be taken while collecting this information that it may not cause any emotional trauma and keeping in mind that the victim may feel guilty or ashamed. Victims may avoid such types of questions or give a negative answer because of internal fear that they did something wrong. In a situation where the victim has taken such actions, he/she should be informed that more evidence still might be recovered or identified.

If the victim has not done any of these things, communications staff must request the victim not to do so that he or she withdraw and explicitly clarify why—the reasons for the request if the suspect, for example, has to urinate and can't wait for the cops to arrive. He or she should be told where to put the urine collection tube to pee in a clean jar or container.

However, if the victim has not done any of these activities, it is necessary for personnel to explain that he or she not do so and to elaborate the reason for doing so. In situation where officer is not able to respond with a urine collection container and victim has need to urinate, in such situation, a clean jar or container having a lid should be used till officer responds.. Additionally, the victim should be asked not to wash cloth and to collect the clothing that was worn at the time of assault; if possible, keep it inside a clean paper bag.

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## 7.5 Investigating Officer Response

Officers should follow standard emergency management protocols when responding to a sexual harassment scene, including ensuring the victim's safety and, where necessary, also beginning of search of the perpetrator. After ensuring the victim's safety, officers can make appropriate attempts to enable the survivor to ascertain the scene, location, date, and time of the incident, where the preliminary report will be made. The officer should specifically clarify the report process, including the functions of the first responder, investigating team, and everyone else the victim will interact with.

The officer is frequently in charge of initiating the investigation. After safeguarding that the survivor requires no urgent transportation to a health centre, officer can proceed with the initial interview. The interview can specifically have questions which would determine the necessary details of the assault and comprise the evidence required for the investigation, like perpetrator identity, name, and characteristics of crime; the mental and physical state of the victim should be taken into account while asking questions. The victim may be told that a second interview with a professional investigator will take place at a later stage. During the first questioning, the victim may be asked about anyone he or she reported about the sexual attack. The first individual the victim talked about the assault should be identified and examined in particular because this "outcry witness" will be helpful to validate the legitimacy of the survivor. This is especially relevant if the suspect raises a consent defence or in delayed reports. Officers should record any type of physical injury and inquire about any indication or signs and symptoms of injury around neck area or strangulation. The signs may be like petechiae, any defence marks like fingernail mark on neck and face, abrasion, bruises, any sort of discoloration on the neck area, swelling of the tongue, difficulty in eating, and breathing; all these things should be taken into account [49]. On the requirement of forensic medical examination and the victim approves for it, the officer needs to make arrangements for travelling to the specified facility. Proper chain of custody should be maintained. During transportation of victim, the victim's body should be considered like a crime scene whose protection is a priority.

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## 7.6 Drug Facilitated Sexual Assault

This type of sexual assault is much more complicated due to the use of alcohol and date rape drugs. Excess alcohol consumption by the victim leads to a state of unconsciousness, and thereby, offender sexually assaults the victim. In cases of date rape drugs, the victim becomes unconscious and in a state of deep sleep unaware of the condition and situation. The investigation is much more complicated in drug-facilitated sexual assaults reason being drugs like Flunitrazepam, Rohypnol, GHB, which affect the nervous system and lead to memory loss; the victim is not able to recall the event that occurred in the last few hours. The victim may or may not be able to recall that something has happened with her; if she suspects something, maybe after few days, it becomes too late because of the high chances of loss of evidence during that time [50]. First responders must understand that while Rohypnol and gamma-hydroxybutyrate (GHB) are commonly publicized in drug-facilitated sexual assault as the “drugs of choice”, assailants can use various other substances to facilitate sexual assault (including alcohol). They need to know the significance of collecting samples of toxicology as medically required or suspected of alcohol or drug-facilitated sexual abuse, as well as the value of obtaining patients’ informed consent before collection of the sample. They should also be aware that toxicology sample processing is usually separate from the forensic evidence collection kit for sexual abuse, and toxicology analysis procedures can be different from other evidence analysis procedures [51].

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## 7.7 Delayed Report

Some victim of sexual assault may not report the incidence; the causes are special to each person and can comprise the victim's state of mind or feeling of guilt, humiliation, denial, shock, self-blame, and ambiguity about the incident—if it is a sexual assault or not, fear of nobody will believe, and anxiety about family and friends finding out about the incident, and mistrust of the judicial system both apprehension over the effects and in what way they would affect the life. Officers must be cooperative with all the parts of the victim where she feels hesitancy. Officers must be mindful that concerns related with delayed report should cause victims to think the officer does not believe her version of events or may blame her for the incident. Although the details for a delayed filing must be reported, a delay in reporting the incident should be regarded as genuine and should not be seen as proof that the victim is falsifying about the incident [52].

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## 7.8 Role of Supervisor

When a sexual assault is reported, the standard incident response protocol is followed; a supervisor is needed to confirm about the investigation that it is done appropriately with a victim-centric/oriented approach and to respond to support

officers conducting sexual harassment cases where possible or when ordered by an officer.

To make sure the polygraph tests are never conducted on victims of sexual harassment, agencies may be penalized under the Violence Against Women Act. Conduct after-action investigations and sexual harassment investigation audit on all sexual assault cases to ensure their credibility and continuity. Encourage police to look for simultaneously occurring and interconnected crimes/incidents. Ensure that the investigating officer and other investigators in case understand case coding and that sexual harassment reports are properly coded.

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## **7.9 Victims Advocate**

Victim counsellors will be particularly supportive in sexual harassment cases and can be contacted as quickly as possible for encouragement or moral support also to help the victim in taking rational decisions during the investigation procedure. In seeking an advocate, the cop should relay information about the victim's medical needs, such as linguistic problems or mental health concerns, or physical disability, as well as the requirement of an advocate to the victim to be of same gender. Victim advocates operate within and outside of the criminal justice system. Because of their links to the administration, most advocates in the criminal justice system are not given counsellor privilege. Community-based advocates, on the other hand, generally do have counsellor communication authority. Specifically, privilege laws may halt counsellors from appearing or being necessary to testify in court and several even ranges that ban/restriction to written records. The victim has the opportunity to refuse the advocate's services, and this decision must be accepted by members of the responsible party, including the officer in charge of the investigation. If the survivor refuses help, written referrals for alternative advocates should be provided for assistance. Victim counsellors should not be used as interpreters when doing so puts them in the role of helping with the law enforcement case rather than working on their victim supporting and assisting role. Law enforcement authorities must collaborate with victim advocate groups and others to find new approaches to deliver robust treatment for unique groups such as impaired hearing and speaking and who do not have English as their first language

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## **7.10 Collection of Evidence**

When referring to a complaint of a sexual assault, police must adopt their agency's evidence gathering protocol in the investigation. This includes adhering to the established procedures for collecting DNA evidence and maintaining the chain of custody, ensuring proper collection, labelling packaging, and forwarding of evidence. Clothing worn during the assault should be firstly collected by the officer and immediately after that, particularly clothing. Closest to the vaginal region, comprising undergarments, shorts, skirts, or trousers—every piece of garments should be



packed individually in a paper bag. Also records of photographs and videos of the victim's injury can be made. Photographs can be taken as part of the forensic investigation of most cases by a licensed medical practitioner. However, if the victim refuses the medical forensic test, photos and videos of injuries can be collected and viewed in the context of the investigation by law enforcement. When taking the photograph of victim in these cases, firstly, the officer should obtain permission to photograph any apparent bruises or injury and should prefer drapes or other methods appropriate in protecting the victim's privacy. The person of same sex as that of the victim should be considered wherever possible for photographing. The photography of private parts like genitalia should be taken specifically to be a part of the forensic or medical examination and should never be taken by officers of law enforcement. The confidentiality and integrity of these photographs should be controlled and maintained properly.

Furthermore, officers should concentrate on gathering information or evidence to track the suspect's use of alcohol or drugs to establish vulnerabilities to victim and threats posed by the accused/suspect, as well as the setting in which the attack happened, including signs of alienation and soundproofing. Investigators also consider or take into account other evidence probably encountered in drug-facilitated sexual assault cases [53]. Such type of evidence can potentially be located at the suspect's residence, at the home, locker, at employment place, or in a vehicle. This evidence can be in the form of drugs (tablets, capsules, powder), raw materials for making drugs, recipes, and literature related to the use of date rape drugs. From electronic gadgets of suspect, the victim's related information like photographs and videos can be obtained. Additional to that, the officer must also search for the person who may have seen the suspect and victim together or using drugs or alcohol.

In cases where suspects accept that sexual contact existed but simply argue that it was done with the consent of the victim, officers should concentrate on gathering evidence of prior attacks or violence, intimidation, threats, or stalking. Other evidence need to be collected to record the perpetrator pattern of action, as well as selection and grooming procedures, false conditions, behaviour before and after the assault like any form of communication, or any suspicious manipulative behaviour by the suspect. Officers handling cases in which the sexual assault is done by a strangers, on the other hand, should base their forensic activities on the identification of trace evidences and majorly to get DNA profiling done that can be used to track down the suspect. Events that occurred before and after the attack should be documented to identify any additional witnesses and forensic evidence, locations that may help in getting more evidences.

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## 7.11 Victims Interview

In cases where the accused is familiar to the victim, the officer should ask as to how long the survivor has known the accused, the situations of their encounter, and the severity of their prior partnership, and what, if any, behavioural problems they had

changed caused the position to shift from one based on consent or permission to one based on need/force or intimidation.

Following questions should be asked by the officer:

1. The site of the attack, as well as any isolation techniques used by the suspect like isolating the victim from relatives, taking the victim to a distant location, or requesting that the survivor travel somewhere private
2. The suspect's actions, threats (real, assumed, or indicated), movements, intimidation, and other activities.
3. Methods with which the victim refused or implied non-consent, whether verbally and nonverbally. Nonverbal cues may include standing still, resisting contact, and being silent.
4. The victim's behaviour before and after the sexual attack, as well as his or her emotional health during the assault.
5. The feelings and thoughts of the victim during the assault.
6. Peripheral details and sensory evidence which the victim has seen.
7. The victim's post-assault behaviour and emotions, including shifts in routine, exhaustion, mood fluctuations, sleep and food disruptions, flashbacks, nightmares, and tremors.
8. Any form of pre- or post-assault communication, tracking, harassment, or other suspicious activity.

Investigators should often question victims of sexual harassment about any conditions which indicates the involvement of a substance for doing the sexual assault (e.g., at the time of the abuse, the victim was under the effect of drugs, any memory loss, disorientation, or confusion encountered by the survivor, serious illness, or hallucinations). Usage of any drug prescribed should also be taken into notice. However, investigators must make it familiar with the survivor that drug misuse do not confirm the allegations of sexual assault have occurred. When drugs or alcohol are used, the victim memory about the sexual assault is very little. The victim's statement about the event might have significant gaps, making it very difficult in explaining what has happened with her, to the officer in charge of the inquiry. Because of this, the victim might be enormously anxious or nervous during the Interview. Investigating officer must be cooperative and be patient and polite and with an open mind listen to the victim as she recalls the scene. Also, investigators must keep in mind that a victim whose memory is compromised as a result of a drug's pharmacological impact can be fill up the blanks or gaps in recall in the event unintentionally in one's mind. As a consequence, investigators or examiners must stop asking any suggestive or leading questions during the interview.

Victims must express how they feel or what they were doing before becoming unconscious. It is also important to interview any person who may have heard or spoken or seen before or after the attack on the victim. Frequently, it is that person who could act as a witness and who determine time period, confirm suspicious or abnormal conduct or behaviour, include vital information, and identify the important piece of information. This thing should be taken into consideration that that in few

cases of sexual harassment, victims may withhold information from their original account of the crime that they consider humiliating or inappropriate or intimate. As a result, investigators should anticipate any hesitation on the part of the survivor to explain uncomfortable evidence. Additionally, the investigator specifies the relevant details that need to be discussed to determine the legal aspects of the crime and proceed the investigation and start the trial.

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## 7.12 Approaching Suspect and Interviewing

Officers can perform a background search before contacting the suspect, primarily checking for allegations, criminal records/charges, and punishment given for similar type of crimes, especially violent crimes and breaches of security orders. The investigator may also try to connect with staff from other departments within the department, as well as those from other organizations, to establish correlations or evidence or patterns that are similar to other types of violence, such as indecent exposure or voyeurism.

Depending on the jurisdictional laws, officers may also consider of making a pretextual or confrontational call or texting. There are registered phone calls. Typically, the victim initiates the process while being supervised by a group of law enforcement officers with the mission of obtaining the suspect's incriminating comments; all these actions depend on the mental and physical state of the victim and preferred to be done in the presence of an advocate of the victim for support.

Officers must follow their agency's protocol when questioning offenders, which should include instructions when performing custodial and noncustodial interviews as well as interview recording. Officers should question the suspect how a person should indicate or express non-consent for intercourse. The explanation by the suspect may be helpful in further proceedings mainly if they try to the consent defence.

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## 7.13 Protection of Victim

To the extent possible by law and policy, law enforcement officers must assure to preserve the privacy or confidentiality of the victim's records. The duty of investigator also includes that they must ensure that victims are aware of their rights as a crime victims as per state law—that they have the right to remove their name from public record and to be available and give a statement at the proceedings. The survivor, witnesses, and the third parties have the right not to get harassed or intimidated by the perpetrator/suspect. If such rules are broken, the investigator may clarify how to call law enforcement, including telling the client to dial 911 in emergency. The victim should be given the report number, including contact details of the officer in charge of monitoring and chief investigator the subsequent person handling the case. Finally, victims should be informed about decisions on arrest, victim benefits, special restraining court dates, orders, and releasing date parole. Additionally

officers may also notify the survivor of the likelihood of public attention, including the information provided to the media houses about sexual harassment victims and media attention. By developing multi-agency holistic guidelines for responding to sexual harassment, organizations should make sure that the victims are safe and get the best care and support.

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## **7.14 Medical and Forensic Examinations in Sexual Assault**

In sexual assault, forensic investigation and medical examination have the potential to address number of the questions of sexually assaulted victims and will raise the probability of help from collecting evidence and aid in the investigation and conviction of the perpetrator.

### **7.14.1 Time Guidelines**

While many jurisdictions historically take a time span of 72–96 h for gathering evidence after a sexual assault, numerous have stepped away from this procedure, toward a longer time span of 120–168 h. Evidence collection, medical treatment for STIs, pregnancy, and the recording of injury are frequently likely even after that time span (up to 10 days after the sexual assault) and should be done to document injuries. Toxicological evidence in sexual assault cases should be collected up to 5 days after the assault [54]. If the sexual assault is done by a stranger in such case, DNA and biological evidence may have a huge influence on the likelihood of identifying the assailant and make him responsible for the assault. In such cases, an evidence collection by forensic examiners may be done up to three weeks after a vaginal sexual assault; subsequently, potential evidence can still be recoverable.

If there is a suspicion that the attack was committed in such situation where victim was unable to give consent, or unable to recall, unable to explain lapses, or unaware of a complete description of the attack, complete toxicology tests must be carried out. The victim should be told of the importance of getting a toxicology test to determine the effects of alcohol and medications at the time of the attack. Such kind of medications along with alcohol may have harmful effects on the victim's body.

Where a drug-assisted sexual attack is alleged, a urine sample must be taken as early as possible, although this can be obtained later up to 120 h after the incident. A blood sample can be taken if it has been less than 24 h since the assault. Many sexual assaults go unreported/delayed in reporting the department should collaborate with laboratories that are accomplished in detecting very low amounts of medications/drugs widely used in sexual abuse in collected urine and blood. Samples, victims' illicit drug abuse, like underage alcohol, should not be used to dishonour or deter the victim from reporting the incident. For the officials of law enforcements, the priority should be to thoroughly investigate the victim, not prosecute the victim for violating rules.

### 7.14.2 Collection of Samples

Urine has a wider detection range for medications widely used in these situations than semen. The earlier a urine test is collected after an attack, the better the odds of finding contaminants that are rapidly degraded—removed from the body.

- (a) **Urine samples from victim**—If patients might have taken a substance used to facilitate sexual abuse during the previous 96 h, a urine sample of at minimum 30 mL, ideally 100 mL (around 3 ounces), should be collected in a glass jar or sterile plastic (as per protocol)—not sterile the urine sample (e.g. bacteria present in the urine would not interfere with analysis or results). In situations when patients are unable to wait until they arrive at the exam centre to urinate, first responders can ask them to supply a sample to carry it to the facility, thus recording the chain of custody [48].
- (b) **Blood samples from the victim**—When necessary, take a blood sample. If medications used to promote sexual abuse were consumed during the previous 24 h, a blood sample minimum of 20 mL should be obtained in a gray-top tube (having preservatives potassium oxalate and sodium fluoride), as per jurisdictional guidelines [48].
- (c) **Sample collection from the suspect**—The medical examiner should collect the samples specified in the warrant during the examination. This may include penile swabs, combing of pubic hairs, and other sources of DNA evidence. Additional trace and biological evidence should be gathered in compliance with the agency's evidence collection policies. In comparison to those biological specimens, as well as trace proof, the forensic investigator can keep track of information of the suspect's clothing, tattoos, scars, piercings, and any other distinguishing/unique features.
- (d) **Preservation of evidence and chain of custody**—The toxicology lab's specifications for specimen processing, packing, marking, preparation, handling, and distribution should be known by all concerned healthcare staff. Policies for storing these samples while patients are not present should be in effect. The chain of custody, as with all forensic evidence, must be maintained.

### 7.14.3 Recent Investigation Techniques in Sexual Offences DEPArray™ System for Sexual Offense Evidence Processing

The understanding of DNA mixtures from heterogeneous samples remains a key challenge in forensic community. Identification, collection, and analysis of a single cell or cluster of cells possess a widespread inference in the examination of forensic evidences. So, while processing and interpreting heterogeneous DNA mixtures obtained in sexual assault cases, deconvolution is necessary. Within the forensic science community, there is a great need to find creative, stable, and reliable methods for physically separating these heterogeneous sources in order to minimize an already backlogged system.

While DNA analysis, processing of DNA evidence and serological analysis are much focused. However, to increase the efficacy and augmentation of downstream DNA, analysis development of improved serological techniques shows a positive result. Many techniques like light microscopy, differential extraction method, fluorescent-activated cell sorting (FACS), or laser capture microdissection (LCM) are being investigated for the separation of distinct cells from the mixtures of DNA, but none of these shows a promising result in the separation of different types of cells. These techniques sometimes fail to separate adequate human sperm cells from mixtures of epithelial cells and other cells.

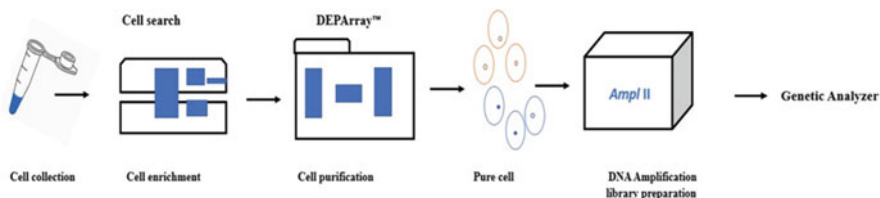
A semen is the most frequently found evidence of a sexual offense. Its detection is necessary in investigating the sexual crime; affirming its essence on samples obtained from the body cavities gives almost verifiable proof of direct sexual contact. Nonetheless, the utmost important objective of forensic examination is to determine a genetic profile of a sample to identify the culprit. The standard protocol of genetic profiling in forensics includes isolation, quantification, STR amplification, and analysis of DNA sequence by means of various commercially available kits which are extremely efficient in generating genetic profile from trace amount of DNA sample. In spite of high efficacy, these technologies cannot produce promising results in case of DNA mixtures, having biological fluids from two or more individuals and lead to the production of mixed genetic profile. One of the major glitches of forensic genetics is biological mixtures.

Nowadays, to overcome the limitations of the above-mentioned techniques, DEPArray™ image-based and highly automated technology successfully allows the isolation of pure cells with single cell resolution from 100% homogeneous samples. It is highly robust and sensitive technique. DEPArray™ technology ensures genomic and expression analysis at the single cell level and enables the forensic scientist to successfully analyses mixed biological evidences [55].

DEPArray™ technology includes a benchtop instrument, DEPArray™ cartridge, and DEPArray™ analysis platform. DEPArray™ cartridge is a microfluidic cartridge that consists of array of individual electrodes with embedded sensors that allow dielectrophoretic (DEP) cages to be built around the cells. It is based on the electrokinetic theory that produces an electric field force on neutral and polarized particles such as cells suspended in the liquid which in turn control manipulation and collections of individual cells of interest ranging from small sperm cells to large epithelial cells. Isolated cells are then transferred to a field cage with stable levitation due to the change in electric field pattern. The fluorescent microscope is attached to the DEPArray which acquires high-resolution cells images and measures cells intensity and morphological parameters [56].

Collected data are displayed in the CellBrowser™ software, which provides multiple analysis tools for cell identification and selection: the high level of technology and automation minimizes the operator interaction with the DEPArray™ system to the selection of the desired cells. Selected cells are collected in homogeneous groups or as single cells, with clean drops of buffer into a 0.2 mL tube, and are then ready for further genetic analysis. The major advantage of DEPArray includes the (a) identification and isolation of specific sperm cells before the DNA extraction,

(b) being highly sensitive in the detection of sperm cells from the biological mixtures, (c) DNA quantification takes place directly by cell counting which further exclude the requirement of quantitative PCR, (d) potential inhibitors being shut off which leads the way to enhanced amplification, (e) low template DNA samples showed improved resolution and interpretability [57].



## 7.15 Procedure

### 7.15.1 DEPAArray™ Sample Processing

DEPAArray™ forensic sample preparation kits are available for the sample preparation which permits the recognition, identification, and extraction of different cells such as human sperm, epithelial cells, and white blood cells from the collected biological mixtures swabs. Cells are concentrated by centrifugation and stained using specific antibody conjugates like fluorescein, allophycocyanin and phycoerythrin, and 4,6-diamidino-2-phenylindole [56].

### 7.15.2 Differential Extractions

All the samples are suspended in digest buffer, proteinase K, and incubated for 1 h at 56 °C. After that, swabs of samples are spun where the epithelial fractions of cells are removed and remaining cell pellets will be resuspended and washed in digest buffer. Epithelial and sperm cell-obtained fractions are then processed using DNA IQ™ Casework Pro-Kit and Maxwell® 16 (Promega) which contain 1-thioglycerol to extract sperm cells. Aging extracted sperm cells are resuspended in proteinase K, 1-thioglycerol, and casework extraction buffer, further incubated for 30 min at 56 °C. Subsequently, lysis buffer is added in incubated each fraction and analyses under Maxwell 16 which is preprogrammed with DNA purification procedure. Extracted samples are concentrated using millipore filters and quantified using qPCR assay to determine male and total human DNA concentrations and also at the same time quantify autosomal and Y-chromosome DNA [55, 58].

### 7.15.3 Amplification and Analyses

All the samples are amplified using an amplification kit which allows co-amplification and fluorescent detection of the 18 autosomal loci in the expanded CODIS core loci and further analyzed using genetic analyser [58].

### 7.15.4 Bite Mark Utility in Sexual Offences

Bite marks can be found in sexual assault cases while not very prevalent in other attacks. The adequate information of the teeth is transferred to the bite marks; it can be useful in identifying the human [59]. One of the good techniques for obtaining the evidence of bite marks is photography. The role of ABFO scale II in photography has been well known for the compilation of evidence of bite marks [60].

During photography, if ABFO scale II is used, photography can effectively be used during the Gorea and Jasuja process to translate to life size [61]. There have been various approaches to equate the teeth with the bite marks, but most of the bite marks are compared using simple methods such as acetate translucent overlays [62].

For the measurement of bite marks as a 3-D structure, few new methods have been designed using electron microscopy, stereomicroscope, and optical overlays of bite marks for the DNA fingerprinting using saliva found on the bite marks [63]. Bacteria found on the bite mark can help in identification by its genomic profiling [64]. Depending upon the case, a particular method can be used for bite mark analysis as acetate sheet can be used for the overlay of bite marks as it is a easy, helpful, and cheap method for the identification [65].

### 7.15.5 Bite Mark Documentation and Analysis: The Forensic 3D/CAD-Supported Photogrammetry Approach

The forensic 3D/CAD supported photogrammetry is a technique used to document and record the small objects from the surface. The technique makes it possible to analyse patterned skin, soft tissue or bone injuries to match potentially incriminating instruments in form, size, and angle [66, 67].

Taking a series of images or scanning involves three-dimensional recording of items to be studied. The examination of 3-D recorded objects needed a series of photographs. A computer system then determines the location of key locations on the items' surface in space and then generates three-dimensional representations of the items. These data models are used to create graphical true-to- object volume models using a 3D/CAD program. The objects in question, such as the bite mark and the teeth of the dental cast of a perpetrator, may then be randomly pushed against each other on the 3D screen for contrast and measurement and likely to assess their coherence [67]. The visual properties of the representation may further enhance the additional outline of the photogrammetric 3D model of the artefact with a two-dimensional image of the bite mark.



In this method, the implicated cast does not obscure the patterned structures of the injury site, as is common when the teeth or the cast is in the focus and the bite mark is in the periphery. Curved illustration, or a reversed reflection of the bite mark, shows accurate visualisation of the bite mark's progression. The cast is depicted here as penetrating the bite mark from behind, which showed the virtual viewpoint from beneath the skin [68].

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## 7.16 Spermatozoa Detection Using Ultrasound Technique

The variety of discipline are involved in the study of the sexual offence in criminal context which helps in reconstructing the criminal act by examining different forensic evidences found at the crime scene and victim. The biological evidence like semen, blood, and vaginal secretions found at the scene of crime are analyzed by forensic biologist using various biological methods and procedures applied to a criminal context to determine if a sexual crime has been committed which aid in the confirmation or refutation of potential aggressors. Among all the biological evidence while investigating the alleged victim of sexual offence, semen is the most vital evidence. The spermatozoa present in the semen can be detected using various staining techniques such as Christmas tree test. This includes the extraction and dilution of sample in distilled water and buffer so that the spermatozoa cells get freed in to the medium. It is a conventical method of sperm cell detection but requires to ensure that sperm cells must be freed in to the extraction buffer without any degradation. To increase the efficiency of sperm cells recovery, a technique based on ultrasound waves has been revolutionized. This technique utilizes ultrasound waves to extract the sperm cells from the sample without affecting their morphology and quantity. The sample is added in a diluting medium and placed in an ultrasonicator. The sound waves in the sonicator travel through the aqueous medium and free all the sperm cells present in the swab or cotton. With the application of this technique, it is possible to recover higher number of sperm cells in negative samples like garments [69].

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## 7.17 Conclusion

Sexual crimes are a major concern for enforcement, the general public, and community, and they impact citizens at all levels. Sexual offences are the most horrific and degrading. The sexual crimes considered as a crucial criminal act. The evidences from the crime scene must be collected in a proper way under the supervision of investigating officer. While interrogating the victim of sexual assault, the medical practitioner and investigating officer must take precautionary measures to not hurt the victim's sentiments and mental peace in any manner. The examination of victim should be done by a medical practitioner, and all the relevant evidences like clothes, vaginal swab, urine sample, or any other relevant sample must be collected for the analysis.

A wide range of sophisticated investigative and research techniques are now available. Among them, the DEPArray demonstrates the interpretation of DNA mixtures, which remains a major challenge in forensic evidence research. It allows forensic biology/DNA analytical laboratories to improve their normal workflow. DEPArray workflow results in fewer mixture samples, allows for the purification of sperm and epithelial cell fractions without the need for differential extraction, increases sample amplification success rates, and improves the analysis of low template DNA samples. It also removes the need for additional human sperm confirmation tests and allows for direct recognition of the type and number of cells being tested, removing the need for qPCR-based DNA quantification. The DEPArray has a clear role in the processing of sexual offence data, but it may also be used to process other forms of evidence such as trace or “touch” evidence. It also provides many advantages over other traditional methods of DNA extraction and possesses high specificity and sensitivity.

Extraction of spermatozoa from biological samples using ultrasound wave is another emerging technique. The application of ultrasound waves on biological samples aids in the liberation of cells in the diluting medium as these sound waves pass through the aqueous medium and free the sperm cells attached to the cotton swabs and recuperate a high percentage of sperm cells without being destroyed. So the use of ultra sound techniques increase the sperm cells recovery, without affecting their morphology and quantity.

Bite marks are the common evidence in sexual assault cases which might be helpful in the identification of an individual. The information related to the teeth needs to be recorded by a proper method. The forensic 3D/CAD supported photogrammetry approach helps in documenting and recording the small objects from the surface. This technique helps in analyzing the patterned skin, soft tissue, or bone injuries to match potentially incriminating instruments in form, size, and angle by taking 3D images. Bite marks are also recorded as the 3D structure that later can be compared with the dental cast. The 3D images give the curved illustration that helps in getting the progression of the bite marks. This method serves better-curved photographs for the comparison of bite marks.

**Conflict of Interest** There is no conflict of interest.

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