Forensic Analysis of Semen: A Review

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Abstract:

Semen stain analysis has been a task of Forensic Biology and Serology. Analysis of seminal fluid or semen can provide crucial information for the crime scene investigations mainly in sexual assault cases. The first step of identifying such a body fluid is very important since the nature of the fluid is itself very informative to the investigations driven by the importance for forensic applications, body fluid identification method have been extensively developed in recent years. Detection of semen stain depends on microscopical identifications of spermatozoa and enzyme activity based upon the antigen antibody reactions.

Introduction:

Semen analysis is the examinations of ejaculated seminal fluid found at crime scene. Seminal fluid is a viscous, turbid fluid produced mainly from secretions of seminal vesicles (45-80% of volume) and prostate gland (15-30% of the volume). About 10% of the total volume is the combined mixture of the epididymis glands and bulbourethral glands. An average male ejaculate measures around 3.5 ml each ejaculation. Each milimetre can contain between 10 – 50 milion of sperm cell. This numbers can vary with the age of the male, and can be negatively impacted by the medical conditions, genetic background, diet, habit of smoking and use of illicit drugs.[1]

Collecting seminal fluid for analysis:

While collecting the seminal sample from the crime scene documentation during collection is very important by the help of notes, photography and videography. A clean syringe or disposable pipette is used for collecting the liquid semen sample found to a clean sterile tube.
Also the semen sample can be transferred onto a clean cotton cloth by absorption. The cloth is then air dried, packaged, sealed and labeled properly. If the seminal fluid is found or present on panties, bedsheet, pillows and other movable objects then the objects should be collected as it is found at the scene. If the semen is wet then the sample should be dried before packaging and collection.

While dealing with the sexual assault victims the sample must be collected in the form the oral, vaginal and anal swabs and these swabs should be air dried before packaging for one hour. These samples should be collected from the victim as soon as possible before the body begin breaking down of the various components of seminal fluid through enzymes activity.[2]

**Tests for detection of semen:**

**Presumptive tests -**

Semen is detected using an *Alternative Light Source* such as Ultra-Violet(UV) light. It is routine procedure to search a crime scene for semen and other fluids using this simple and non-destructive method.[3] The Wood’s lamp is a specific device that emits wavelength from about 320-400 nm, and it is very simple, safe and easy to use method. Another alternative source that has been used for seminal fluid is polilight which has a wavelength range of 415 -650nm as well as white and ultraviolet light.[4] The colour of the fluorescence will vary from blue to yellow.[5]

The most popular and accepted presumptive test for the presence of semen is the test for semen is *Seminal Acid Phosphatase (SAP)*. The enzymes have a ability to catalyze the hydrolysis of organic phosphatase which forms a product that will react with a diazoniurn salt chromogen to cause a colour change.[6] One popular substrate/color developer combination is Alpha Naphthyl Phosphate and Brentamine fast blue, Acid Phosphatase will produce a dark purple colour in less than a minute the shade of purple colour will depend on the age of the semen stain and storage conditions. Non semen AP enzyme reactively is markedly slower than when using the above mentioned spot test. AP activity has been detected in dried
samples years after the stain is deposited. However heat and moisture will result in breakdown of the AP in a matters.[7]

Another presumptive test for semen is the detection of Prostate Specific Antigen(PSA) or the P30 molecule. PSA is produced in very high amount by the male prostate gland.[8] PSA is produced in prostate epithelium an secreted in semen. Even present in very small quantities can be detected in urine fickle matter, sweat and milk. The synthesis of PSA is stimulated by endrogen i.e. the stereo harmone.[9]

**Confirmatory Tests for detection**

**Christmas tree test**

The most reliable confirmation for the presence of semen or the seminal fluid. two main reagents are used to produce the results one is Picroindigocarmine stains the nesk and tail portions of the sperms in green and blue and another one is Nuclear Fast Red gives the sperm head a red colour and pink colour to the acrosomal cap i.e. the tip of head acrosomal cap.[10]

**RSID Semen Strip Test**

The RSID semen test provides sensitivity as well as specificity tto human semen.[11] Rsid –semen test identifies the presence of seminal vesicle specific antigen;or the semenogelin.[12]

**Limitation and benefits of the tests for detection of seminal fluid:**

Presumptive test are playing a imported role when attempting to locate an area of interest for further forensic examination and DNA analysis. Reports of their performance and specificity are available.[13,14,15] The presumptive and chemical tests are not human specific and in general are applied sequentially when a mixed body fluid may be present or found. Many rely on the properties of enzymes In body fluid and many of reagents are destructive to the samples.
Sometimes the stains on dark background are difficult to locate and have been visualised by using an alternative light source that use autofluorescence shown by some other body fluid. [16,17] Usefulnesss of these methods can be affected variations between the body fluids and the different surfaces. Exposures to such type of light source may cause damage to the DNA in stain.

In the absence of the microscopic examination of the semen stain or the spermatozoa, semen is identified by the presumptive tests that detects the seminal acid phosphatase, but this is not unique to the seminal fluid. [14,18]

The PSA is also used for the identification of semen common methods include P30 and another (like ABACard P30 and Biosign PSA test, although false positive reaction to urine, vaginal fluids, breasts milk and semen free rectal postmortem swabs have been observed.

Conclusion:

Semen fluid analysis or identification is an important aspects during the investigation of a sexual offence. Detection and identification ability is improving these days there are many test i.e presumptive test are used for detection of semen on the crime scene which provides in no times. And confirmative test provides the result that prove the exact information. But there also some limitation in the test we use these days for detection which are resolving. We should take of sensitivity and specificity of the stains.

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