

A spit can do magic – Saliva in Forensic dentistry

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Abstract

“A drop of saliva can do wonders.” This is doing magic in the world of forensic. Saliva is a fluid secreted in the mouth. It has various functions from preventing dental caries to providing information of the culprit in forensic. Saliva provides the deoxyribonucleic acid (DNA) which can be used for crime detection, in cases of poisoning, animal bites, drug and alcohol abuse, and hormone identification. The popularity of saliva is increasing as it is

cost effective, easily collectable and stored. This article enlightens about the use of saliva in forensic dentistry.

Keywords: Saliva, DNA, bitemarks, drug abuse.

Introduction

Saliva is secreted in the oral cavity by salivary glands both major as well as minor glands.¹ It is composed of various components like enzymes, proteins, electrolytes, mucin, antioxidants, nitrogenous products and mainly water.² Forensic odontology or forensic dentistry is a branch of dentistry science which applies dentistry knowledge in

law reinforcement process by examining living or dead body, including saliva analysis in crime investigation.³ The scope of forensic analysis has been evolving at a faster pace and trying to use all the possible medias available at the crime scene in the investigation procedures. Saliva acts as one of the body fluids which can provide vital information along with blood and semen. This article talks about the role of saliva in various aspects of forensic dentistry starting from DNA profiling to the drug intoxication, bite mark analysis, gender determination, personal identification, hormone detection.⁴ We have also discussed about the method of collection of saliva from the crime scene, its advantages and disadvantages and its reliability.

Role of saliva in DNA profiling

cracking many crime scenes like murder, rape, theft, burglary. One of the most accurate scientific method of collecting DNA is Short tandem repeat (STR) DNA Profiling technology. Crime Scene Investigation (CSI) Team's major work at the crime site is to collect all the evidences that can be used as a source of DNA like blood, semen, tissue or saliva.⁵

Salivary DNA can be collected from the victim's body in case of abuse or bite marks; it can be collected from non living objects like clothing, glasses, food, tobacco products, dental prostheses and envelops. In 1992 the use of saliva in forensic was put forth but it gained the popularity after Sweet et al published about the use of double swabbing technique in collecting saliva from the skin.

The ability to obtain forensic DNA data from salivary evidence was described in 1992, but the standard of practice for salivary DNA collection from skin was truly established when Sweet et al published the double swabbing technique.⁶

Drug intoxication

Drugs like cannabis, cocaine, crack cocaine, heroin, morphine, and benzodiazepines can be detected from saliva. Various methods are used to monitor these levels in saliva like immunoassay wherein these strips have antibodies that binds with a specific component of the drug⁷, radioimmunoassay (RIA) technique which can be used to detect opium (opium will be detected 4 hours after consumption) and drugs like amphetamine, phenobarbital, and morphine.^{8,9} Gas Chromatography or ELISA technique can be used for alcohol abuse cases by checking the ethanol level in saliva which becomes evident after 20 minutes after its consumption.^{8,10} The Drug wipe technique is usually used method to collect saliva from the suspected site. It uses to wipe surfaces from recovering traces of drug residue. Both saliva and sweat are uses this technique.¹¹

Gender identification

Gender determination is possible by using the DNA's of sex cells present in the saliva.⁸ Barr bodies are sex chromatin in females whereas F bodies will be seen in males. Not only that, we can identify the sex hormone levels by Radio Immuno Assay (RIA) therewith determining the gender of the victim.^{8,9}

Bitemark Analysis

In bitemark analysis, the very first thing we need to identify is whether the bitemarks are of humans or animals. Visual examination of the bitemark analysis will guide us initially but we can confirm this using Rapid Stain Identificaiton (RSID) method, which detects the presence of human saliva α -amylase. RSID results if positive suggests that the perpetrator is humans and if negative it is animal.¹² In case of animals, Enzyme-linked immunoassay (ELISA) technique using monoclonal antibody to determine species salivary immunoglobulin A (sIgA) is used.^{9,12} When the monoclonal antibody results

are unsatisfactory, the crossover electrophoresis or double gel diffusion techniques can be used.⁹

Personal identification

In the crime scene, we can recover saliva from various objects or from victim's body. The salivary analysis of this can be useful in personal identification of the suspect.¹³

Methods of detection of saliva from the crime scene

It is visually very difficult to detect saliva from the crime scenes as they might be dried up. We can recover the salivary stains from either skin, clothes, papers or any objects.

Recovery of saliva from skin is bit difficult as it cannot be directly submitted to extraction process. Various methods have been used like alkaline phosphatase, starch, and amylase enzymes can be used for detection of saliva from envelopes and stamps in which these enzymes react with reducing sugars giving a red insoluble precipitate.¹⁴

But use of these enzymes have limitations such as Alkaline phosphatase test is not very specific; it can give false-positive result, if excess starch is present it gives a negative reaction, leading to false-positive result. Whereas Nitrate and thiocyanate salts are also used for the same but it is useful only for 2 days samples.^{11, 14}

For screening of dried salivary stains Lasers, ultraviolet light, quartz arch tube are used. Fluorescence spectroscopy is another technique which is widely used to analyze structure, dynamics, and functional interactions of proteins.¹⁵

Advantages of saliva as a forensic tool

Non –invasive method of collection, easily collected and comparatively safer to blood which has higher potential risk of contamination from hepatitis or AIDS makes saliva more advantageous over blood in the forensic set up.¹⁶

Conclusion

Saliva can be used as a forensic tool in the crime scene as it can do wonders by determining the gender, in drug intoxications, personal identification, bitemark analysis and DNA profiling. So it compiles us to give the same importance for saliva as other body fluids like blood or semen in the field of forensic.

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