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Application of Nanotechnology for Development of Latent Lip Prints: A Review

ANNU SAINI[1], CHITRANG DIXIT*[1], URVASHI DIXIT[2], ROHIT AWANA[2]

ABSTRACT

The forensic science is the scientific approach to identify these existing identities. From the beginning of the civilization, identification of a person uses to be an integral part of various legal and cultural activities. Forensic science is used not only to identify the criminal but also to solve the hidden mysteries of the past. With the modernization of the society, the need of personal identification also became an integral part of forensic sciences, weather its recording fingerprints for biometric attendance or dental records for estimation of age.

KEYWORDS: Nanotechnology, Lip Prints, Chelipscopy

INTRODUCTION

"Existence is Identity, Consciousness is Identification." --Ayn Rand

Since ancient times, the presence of a person at the crime scene used to be predicted by the fingerprints found at the crime scene.[1-7] Collection of fingerprints became the prerequisite of any forensic investigation. The fingerprint powder will fix to the residues left by the finger and give rise to the distinctive patterns that help to identify an individual. Latent fingerprints are commonly developed by various colored materials.[7-11]

In the era of nanotechnology, different nanomaterials are utilized to develop latent fingerprints. Nanomaterials like CdSe, ZnO, TiO, Gold nanoparticles are used to develop latent fingerprints on porous as well as non-porous surfaces.[13-17]

Unlike fingerprints and DNA fingerprints, lip-prints are also unique identification tool and does not change during the entire lifespan of a person.[6-8,11,12] Use of lip prints in forensic sciences for personal identification is of paramount importance in judicial settings and court proceedings.[6,7,11]

CHEILOSCOPY

Lip prints are normal lines and fissures in the forms of wrinkles and grooves present in the zone of transition of human lip, between the inner labial mucosa and outer skin, examination of which is known as cheiloscopy.[6-10] It deals with examination of system of furrows on the red part of human lips. The creases on the vermilion border of the lips, which appear as white areas in lip prints, and the raised reddish areas outlined by these creases, which appear as dark areas, are analogous to the furrows and ridges of friction ridge skin. The creases on the vermilion border are also referred to as grooves, furrows, wrinkles and valleys.

Lip prints are unique and do not change during the life of a person. It has been verified that they recover after undergoing alterations like trauma, inflammation and diseases like herpes and that the disposition and form of the furrows does not vary with environmental factors. The lip prints of parents and children and those of siblings have shown some similarities. It has also been suggested that variations in patterns among males and females could help in sex determination.

COMPOSITION OF FINGERPRINTS AND LIP PRINT

The composition of fingerprints consists Sebaceous, Eccrine, Apocrine glands secretions which contains organic (Glycerides, Fatty acids, Wax ester, Squalene, Sterol esters, Sterols, Amino acids, Proteins, Urea, Uric acid, Lactic acid, Sugars, Creatinine, Choline, Carbohydrates) as well as inorganic (Chlorides, Metal ions, Sulfates, Phosphates, Ammonia, Water, Iron) salts. The most common technique for latent fingerprint detection is the powder method, in which powdered materials are applied in the crime scene vicinity and it is adsorbed on the sweat residue, secretions and eccrine (98% water + 20% moisture) on the fingers to obtain fingerprints. Similarly, the powder

applied on the latent lip prints can be detected due to presence of organic (Peptides, histatins, cystatins, statherin, sialin, cathelicidin, defensin, growth factors, non-enzymatic proteins include mucins, lactoferrins, proline-rich proteins (PRPs), calprotectin, interferon, albumins and globulins) and inorganic salts (potassium, sodium, calcium, magnesium and ammonium cations. The anionic group is composed of phosphates, carbonates, chlorides, rhodium and a number of micronutrients).

NANOTECHNOLOGY FOR DEVELOPMENT OF LATENT FINGERPRINTS

Nanotechnology have wide variety of application in different fields like medicine, engineering, electrical etc. Nanotechnology is an advanced science, and due to its advantages in various fields, it is referred to as a universal purpose technology since it has its impact on relatively on all fields, industries and all areas of civilization.

Nano-forensics, a completely new area of forensic science, nanotechnology is beginning to have an impact on the handling of evidence at crime scenes, its analysis in the laboratory and its presentation in the court room. Application of nanotechnology is likely to enhance the capacity of toxic materials, forensic evidence in tissue, materials and soil.

The application of nanomaterial for the development of latent prints is likely to become a breakthrough in the world of forensic sciences. In a study titled Rare Earth Fluorescent Nanomaterials for Enhanced Development of Latent Fingerprints Meng Wang Ming Li developed latent finger prints by using rare earth materials europium oxide, yttrium oxide, lanthanum oxide. In another study conducted by Divya V and colleagues proved that the fluorescent and amphiphilic silica nano powder is very efficient for developing latent fingerprints on various surfaces under illumination with 365 nm wavelength UV light. Chavez et al. demonstrated the developed finger prints on Low Contrast Surfaces using Phosphorescent Nanomaterials. Zhaolei Wang, Xue Jiang developed latent fingerprints by utilizing hydrophilic $Fe_3O_4@SiO_2$-CdTe nanoparticles the results confirmed that the bifunctional NPs have good magnetic and strong fluorescent properties favorable for their application in the detection of latent fingerprints.

These nanosized particles, when used as a developmental method in the latent fingerprinting, reflect numerous advantages over conventional methods. These particles can easily be employed to reveal fingerprints on various surfaces and has excellent potential for envisioning of finger ridge detailing in a more precise way. This reflects the better discernibility of nanoparticles over commercially available conventional materials used for fingerprinting.

APPLICATION OF NANOMATERIALS FOR THE DEVELOPMENT OF LIP PRINTS

Recently most of the studies on lip prints are basically focused on gender determination and correlation with blood group or prevalence-based studies. Lip prints as an adjuvant forensic tool has a great potential in the field of forensic sciences. The studies based on different method of development of latent lip print should be of prime concern. Previous studies use material like sudan III, magnetic black powder and lipstick marks from lip prints to develop lip prints. In the present era of nanotechnology, nanomaterials like metal oxide nanoparticles, gold nanoparticles, silver nanoparticle etc. can be used for better results.

In a study conducted by Suresh C et al. titled "Facile LaOF: Sm_3+ based labeling agent and their applications in residue chemistry of latent fingerprint and cheiloscopy under UV–visible light indicated the utility of LaOF: Sm_3+ (5 mol%) NPs in visualization of LFPs, lips print as well as useful component in solid state lighting applications.

The application of nanomaterial for the development of lip prints is likely to become a breakthrough in the world of forensic sciences. In future other nanomaterials can be used to develop and analyze latent lip prints.

CONCLUSION

The lip-print detection method is crucial in providing evidence for crime investigations which can be presented in court. Nanotechnology is therefore developing in forensic research to effortlessly acquire evidence at crime scenes and their surroundings and present this after laboratory analysis in a court of law. The growing demand of nanotechnology today has enabled most of the scientist and analyst to go in the efficient strategic objectives and sound skills in the field of nanotechnology. Additionally, further studies using different nanoparticles on different population group can facilitate the development of multiple regression models that could possibly enhance human identification.

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AUTHOR AFFILIATIONS: (*: Corresponding Author)
1. Senior Lecturer, Department of Oral Medicine and Radiology, ITS Dental College, Hospital and Research Centre, Greater Noida
2. Private Practitioner, Noida

Contact e-mail for corresponding author: dr.chitrangdixit[at]live[dot]com