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Latent Lip Print: A New Possibility

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Abstract:

One of the first things investigators look for at the scene of a crime is prints. They hope to find fingerprints on items in the house, footprints in the soil outside the house and even tire prints. Fingerprints are one of the most effective methods of identification. However lip prints can also provide important information. At the present time more and more people use protecting lipsticks and permanent lipsticks. Also male suspects leave lip prints at the crime site which are crucial evidence in crime scene investigation. When these latent prints are generated by contact with a surface and, like with the latent fingerprints occur, this latent lip print can be developed by various methods. Though there are several methods to identify latent finger prints but not many techniques are explored in case of latent lip print. The present article aims to review the various techniques used to develop latent lip prints and the newer arenas yet to be explored.

Keywords: Latent lip print; Ninhydrin and analogues.

Introduction

A patent print is simply a visible print. Many of these types of prints are wholly visible to the unaided eye, and only some form of imaging is needed for preservation. The word *latent* means hidden or unseen. Latent prints are undetectable until brought out with a physical or chemical process designed to enhance latent print residue.

In a crime scene investigation, fingerprints are the most common and surest means of identification.[1,2] Although lip prints are less studied than finger prints they also offer the possibility of definitive identification.[3,4] The lips are covered with wrinkles and grooves that forms characteristic pattern known as the lip print. The vermillion border of the lips has minor salivary and sebaceous glands which, together with the moisturizing done by the tongue leads to the possibility of existence of latent lip prints. So when searching for lip prints one must always consider the presence of latent lip prints.

Searching for lip prints in a crime scene investigation can be very important in establishing the true nature of the facts. Lip prints can link a subject to a specific location if found on clothes or other objects, such as glasses, cups or even cigarette butts. The lip prints always do not leave a visible mark as more and more people use transfer resistant lipsticks and also males do not wear lipsticks at all. These invisible lip prints are called as latent lip prints.

In addition to fingerprints, lipstick prints can be of forensic interest. Lipsticks are complex substances, which have in their

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constitution, oils such as modified castor oil, waxes, organic inks, and inorganic pigments for colour.[5,6] Traditional lipstick produces a print that is initially easily identifiable.[7,8]

Lipsticks are generally worn by females and if the latent print is of male then we have to rely on other latent lip print identifying methods to enhance the visibility of the print. Different lipsticks have different compositions. During the manufacture of long-lasting lipstick, the oil content is reduced to a minimum. Thus, development using conventional powders and reagents is more difficult.

At the present time more and more women also use protecting lipsticks and permanent lipsticks. With these lipsticks a latent lip print is generated by contact with a surface and, like with the latent fingerprints occur, this latent lip print can be developed.

The investigation of latent prints can be fundamental in resolving a criminal act. There are different physical and chemical methods that enable locating and developing latent prints. Latent prints are developed by a number of methods which rely on the fact that sweat and body oils which have been transferred from the body to an object react with a number of reagents to become visible.[9]

Fingerprint powders adhere to sweat and body oils, iodine when heated reacts with sweat, ninhydrin reacts with the amino acids in sweat, heated cyanoacrylate (Super Glue) reveals latent prints, and sweat fluoresces when illuminated by a laser.[10] The property of luminescence can be used for latent print development. Luminescence is specially a useful property for the search of invisible evidences at the scene of a crime.[11]

The development of latent prints depends on various factors

Pre-transfer conditions: These conditions are affected by age, gender, occupation, disease, and the application of lipstick or any other material applied on lips.

Transfer conditions: Dictate whether a suitable impression will be left.[12] These are the conditions of the surface (substrate) being touched, including texture, surface area, surface curvature or shape, surface temperature, condensation, contaminants, and surface residues. The pressure applied during contact (deposition pressure), including lateral force, also contributes to transfer conditions.

*Post-transfer conditions:*These are forces that affect the quality of latent prints after deposition and called as environmental factors.Examples of these factors are physical contact from another surface, water, humidity, temperature and time factor.[12]

Surface types

Correctly identifying the type of surface expected to bear a latent print is an important step toward successful development.

Surfaces are generally separated into three classes

1. *Porous Surfaces:* Porous substrates are generally absorbent and include materials like paper, cardboard, wood, and other forms of cellulose.
2. *Nonporous Surfaces:* Nonporous surfaces do not absorb. These surfaces repel moisture and often appear polished. They include glass, metal, plastics, lacquered or painted wood, and rubber. Latent prints on these substrates are more susceptible to damage because the fingerprint residue resides on the outermost surface. Cyanoacrylate (CA), dye stains, powders, and vacuum metal deposition are usually the best choices to use on these surfaces.
3. *Semiporous Surface*:This type of substrate that does not easily fit into the first two categories but should be mentioned and is considered semiporous. Semiporous surfaces are characterized by their nature to both resist and absorb fingerprint residue. These surfaces include glossy cardboard, glossy

magazine covers, some finished wood, and some cellophane.Semiporous surfaces should be treated with processes intended for both nonporous and porous surfaces.

Various materials used for development of latent prints

Finger print powder

This technique is one of the oldest and most common methods of latent print detection, with one of the earliest references dating back to 1891.[13]

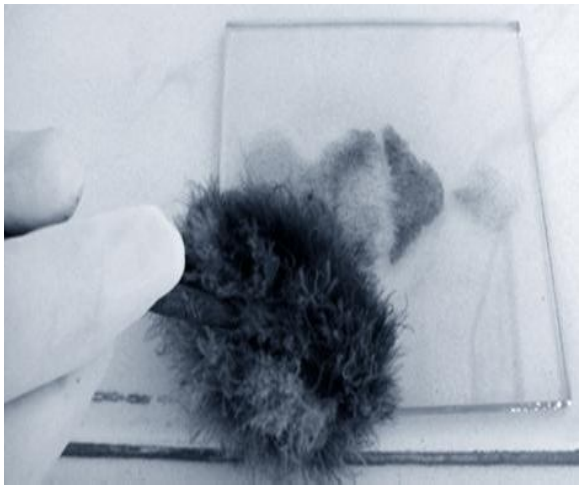
Latent print visualization with powder, or "dusting", involves the application of finely divided particles that physically adhere to the aqueous and oily components in latent print residue on nonporous surfaces.[14]

Early practitioners used a variety of locally available ingredients to make their own dusting powders including charcoal, lead powder, cigar ashes[15] powdered "washing blue", powdered iron, soot[16], and talc.[12]

Commercial powder manufacturers tend to label powders by color, such as black, white, silver, gray, and so forth, rather than labelling the ingredients. Particles that serve as good fingerprint powders include carbon black (colloidal carbon), lamp black, talc, kaolin, aluminium, metal flake, and dolomite among others.[1] Other effective and widely used latent print powders are flake metal powders made from aluminium, zinc, copper, brass, stainless steel, iron, cobalt, and nickel.

Dusting is relatively simple and relies on the adherence of powder to the latent print residue to provide good visibility and definition of latent print detail. Latent print powder has an affinity for moisture and preferentially clings to the residue deposited by friction ridge of the print.[1] It is well accepted that the mechanical attraction between these particles and the moisture and oily components in a print causes adhesion, with absorption being a factor Particle size, shape, relative surface area, and charge appear to play roles as well.[12,17]

Figure 1: Photomicrograph showing magnetic fingerprint powder using magnetized applicator (magna brush)



Powders are typically applied to nonporous surfaces with a soft brush. Powdering is not recommended for porous or highly absorbent surfaces such as uncoated paper or raw wood because other chemical treatments outperform powder on these surfaces. The softness of the bristles is particularly important to prevent damage to fragile latent print residue. Latent prints with a high moisture or oil content are easily damaged by a brush that is too stiff or is used with excessive force. Conventional brushes are typically made with animal hair, fibreglass filaments, or sometimes feathers. (Figure 1)

Powders applied with a traditional filament

Figure 2: Photomicrograph showing sprinkling of black fingerprint powder using Marabou brush

brush consist of very fine particles and are usually low density or "fluffy" in nature. This enables particles to be easily picked up or "loaded" onto the brush filaments. Brushing is accomplished with light and even strokes that resemble painting. It is important always to begin by lightly powdering and slowly building to heavier applications to minimize fingerprint damage.

Another type of powder, called magnetic or magna powder, allows for application with a magnetized rod that has no bristles. This type of powder can be light, dark, or fluorescent and utilizes the ferromagnetic properties of iron powder mixed with pigment powders. The magnetized applicator (magna brush) is dipped into the powder, picking up a ball of the iron and particle mixture, essentially forming its own brush. This ball serves as an effective carrier for pigment particles and is passed back and forth over the substrate to develop latent impressions. (Figure 2)

There are two ways to record or preserve a powdered impression. The most common and simplest method is lifting. To lift a print, good quality transparent tape is placed onto the surface bearing a powdered impression. Common tape size for fingerprint lifting is 1.5–2 in wide. It is then removed and placed on a backing card that contrasts with the color of the powder. Probably the most common lift is of black fingerprint powder placed on a white backing card. The second method is photographic representation of the latent print.

Previous studies analyzed the effectiveness of several fingerprint powders and reagents on lipstick prints. Of these, fingerprint red (Dragon's Red), fingerprint black, and silver metallic powders were found to be the most effective.[18,19] It was also determined that sublimated iodine does not produce development.

Mercedes Alvarez Segui *et al* in 2000 found aluminium and magnetic powders to be effective for developing latent lip prints.[19]

Though finger print powder development is convenient and practical way of collecting latent prints but the quality of latent print is the deciding factor and also the surface and the sensitivity of the technique. Thus, it is necessary to find other development methods that are more sensitive to oils and more easily applied.

Lysochrome dyes

Lysochrome is a generic term for compounds that have the ability to dye fatty acids.[20] Their molecule contains a portion that dissolves in contact with fat (lyso) and another that is responsible for color (chrome). Their use is common in histopathology for determining fats in sections. One of these compounds, Sudan black, has been used as a solvent in ethanol and water to develop latent fingerprints described in the literature about surfaces contaminated with foodstuffs, oils, and other fatty substances.[11]

All lip prints contain lipids which make their development possible by using lysochrome dyes, such as sudan III, oil red O, and sudan black. The use of fluorescent agents is required when the colour of the developer and the colour of the surface on which the lip print lies are the same, or when the lip print is an old brand.

Ana Castello A *et al* in 2002 studied long lasting lipstick prints on porous surfaces using lysochromes and concluded that lysochromes are a highly useful group of compounds for locating and developing recent as well as older latent lip prints.[21]

Castello A *et al* in 2004, attempted to obtain DNA from latent lip prints on porous surfaces (paper handkerchiefs). They determined whether from a latent lip print developed with Sudan Black it was possible to extract DNA of sufficient quality and amount to be amplified, thereby providing potential usefulness for identification. These results indicated that latent lip prints on paper and developed with Sudan Black can be used as a potential DNA source for forensic identification, although it must be remembered that all samples in this essay were

obtained under laboratory conditions. When working on real samples, the researcher may encounter problems such as print or bearer pollution, poor conservation, etc., which will have to be solved in each case.[4]

Castello A *et al* in 2005 and later in 2006 showed that Nile Red was a very effective reagent to develop old latent lip prints on porous surfaces and when the print was deposited on multicoloured or dark surfaces. [22,23] Navarro E *et al* in 2006 showed that sudan III, oil red O, and sudan black were effective for obtaining recent invisible lipstick-contaminated lip mark on corpse's skin.[6] Singh NN *et al* in 2010 compared the efficacy of sudan black, vermilion, and indigo in developing visible and latent lip prints made on bone china cup, satin fabric, and cotton fabric. They found that the vermilion and indigo dye gave comparable results to that of sudan black for developing visible and latent lip prints. The results of the aforementioned study signified that vermilion and indigo being natural, non-toxic, and cost-effective could replicate the already existing chemical reagents like sudan black, sudan III, oil red O, Nile red, as the ability of these natural dyes to develop recent lip prints are comparable to sudan black. However, further studies are required to ascertain the efficacy of these natural dyes to develop lip prints stored in variable conditions over a variable period of time.[24]

Kumar P *et al* in their study analyzed and compared the effectiveness of lysochrome dyes (Sudan III, Oil Red O, and Sudan black) and fluorescent dyes (Nile Blue) on latent lip prints. They found that fluorescent dye produced better positive results than lysochrome dye.[25]

Other methods for development of latent prints include

Ninhydrin and Analogues, 1,8-Diazafluoren-9-one (DFO), 1,2-Indanedione, 5-Methylthioninhydrin (5-MTN), Cyanoacrylate Fuming, Vacuum Metal Deposition.

These methods are more frequently used for fingerprint development and their use in latent lip print development still needs to be explored further.

In conclusion, the search for invisible or latent prints at a crime scene requires increasingly simpler, more sensitive, and effective methods. It is of paramount importance that the method used permit subsequent analyses. Latent lip prints technique and methods needs to be standardized and newer techniques should be explored to widen its horizon to parallel its use with fingerprints.

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