

Evaluation of Latent Lip Prints on Different Porous and Nonporous Surfaces Using Natural and Lysochrome Dyes

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Abstract

Aim/Background: Cheiloscropy is the study of lip prints. Lip prints are unique for individuals. Lip prints can be visible or latent. Lip prints not leaving a visible smear are considered as latent lip prints. These can be present on different porous and nonporous surfaces. Various dyes have been used for the development of latent lip prints on different surfaces. This paper compares the efficacy of naturally available Vermilion powder with that of a lysochrome dye, Sudan III for the development of latent lip prints on different porous and nonporous surfaces. *Materials and Methods:* Two sets of latent lip prints were made on eight different porous and nonporous surfaces. These latent prints were developed by applying Vermilion powder and Sudan III and evaluated for clarity of lip grooves. *Results:* Latent lip prints were developed on majority of surfaces. Lip prints developed with Vermilion powder were comparable to those developed with Sudan III on porous surfaces, while they were better visualised on nonporous surfaces. The lip prints could be appreciated more clearly on nonporous surfaces compared to the porous ones.

Keywords: Cheiloscropy; Latent Lip Prints; Vermilion; Sudan III.

Introduction

According to Keiser-Nielsen, forensic dentistry is defined as the "proper handling and examination of the dental evidence, in the interests of justice, so that the dental finding may be properly presented and evaluated [1]." Forensic odontologists play a vital role not only in age and sex determination but also their role in the identification of an unknown deceased person in mass disaster; identification of the dead bodies or remains of the dead body is very significant.

Recently, forensic odontologists are technically advanced and are involved in digital bite marks and lip print analysis and are also involved in the implementation of various advanced technologies to prove the uniqueness of stomatological structures such as tooth prints, rugae, and lip prints as biometric tools [2].

Cheiloscropy (quiloscopy) can be defined as a

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method of identification of a person based on characteristic arrangement of lines appearing on the red part of lips or as a science dealing with lines appearing on the red part of lips [3]. The word cheiloscropy is derived from Greek *cheilos* means lips, *skopein* means see. Cheiloscropy is applicable in identifying the living as lip print is usually left at crime scenes and may provide a direct clue to the suspect [4].

Lip prints are unique for individuals. The lip print patterns recover after undergoing alterations like trauma, inflammation and diseases like herpes and they do not vary with environmental factors [5]. Age and smoking of cigarettes also do not change the lip print pattern.

The lip prints being uniform throughout the life and characteristics of person can be used to verify the presence or absence of a person from the crime, provided there has been consumption of beverages, drinks, cigarettes, usage of cloth, tissues or napkin, etc., at the crime scene [6].

Lipsticks are complex substances, which have in their constitution, oils such as modified castor oil, waxes, organic inks, and inorganic pigments for

colour [7,8]. Traditional lipsticks produce visible lip prints that can easily be studied. Lip prints obtained with persistent or long lasting lipsticks which do not leave a visible smear due to their minimal oil content and those obtained from non-lipstick-coated lips are considered as latent lip prints [9].

The Vermilion border of the lips has minor salivary and sebaceous glands which, together with the moisturising 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 [10].

Thus latent lip prints can be present on different surfaces that can be categorised as, porous and non-porous.

Porous Surfaces

The porous surfaces are generally absorbent and include materials like paper, cloth, cardboard, wood, and other forms of cellulose.

Nonporous Surfaces

Nonporous surfaces do not absorb. These surfaces repel moisture and often appear polished. They include glass, metal, plastic, lacquered or painted wood, and rubber [10].

Latent prints are not visible to the naked eye and thus require some means of development or enhancement for their visualisation. According to studies, latent prints can be developed using several substances, such as aluminium powder, silver metallic powder, silver nitrate powder, plumb carbonate powder, fat black aniline dye, cobalt oxide, lysochrome dyes, or fluorescent dyes [7,11].

Lysochrome is a generic term for compounds that have the ability to dye fatty acids. Their molecule contains a portion that dissolves in contact with fat (lyso) and another that is responsible for colour (chrome) [10].

Vermilion, commonly known as Sindoor, is a brilliant red or scarlet pigment originally made from the powdered mineral Cinnabar and is chemically mercury (II) sulphide [12].

The aim of the present study was to-1) Compare the efficacy of Vermilion (natural dye) with Sudan III (lysochrome dye) to develop latent lip prints on different porous and nonporous surfaces. 2) To evaluate the quality of lip prints produced on different porous and nonporous surfaces- bond paper, disposable paper cups, white satin fabric, cigarette butts, disposable

plastic tumblers, glass tumblers, ceramic mugs, stainless steel tumblers.

Materials and Methods

Materials used

Long lasting lipstick (Lakme, Hindustan Uniliver Ltd., Mumbai)

Lipstick applicator tips

Bond paper

Disposable paper cups

White satin fabric

Cigarette butts

Disposable plastic tumblers

Glass tumblers

Ceramic mugs

Stainless steel tumblers

Vermilion (Blue Heaven, Bavana)

Sudan III (Fisher Scientific, Mumbai)

Collection of Latent Lip Prints

Long lasting lipstick was applied uniformly on both the lips using applicator tip. Two set of lip impressions were made on different porous and nonporous surfaces using sustained pressure for 5-6 seconds. Porous surfaces included- bond paper, disposable paper cups, white satin fabric and cigarette butts. Nonporous surfaces included- disposable plastic tumblers, glass tumblers, ceramic mugs and stainless steel tumblers. Thus latent lip prints were obtained on eight different surfaces.

Development of Latent Lip Prints

The method used for development of these latent lip prints was powder dusting. Out of the two lip prints obtained on each of the eight different surfaces, one was developed using Vermilion powder and the other using Sudan III. Before use, Vermilion powder was strained through a strainer. The powder (Vermilion or Sudan III) was sprinkled over the latent print and then excess of powder was removed by tapping.

The latent lip prints developed by Vermilion powder and Sudan III were compared for clarity of lip grooves.

Results

The latent lip prints in our study were successfully developed on majority of surfaces using Vermilion powder and Sudan III.

Amongst the porous surfaces the lip prints were more clearly developed on bond paper (Figure 1, 2) and disposable paper cups (Figure 3, 4) than white satin fabric (Figure 5, 6) and cigarette butts. The lip prints developed with Vermilion powder were comparable to those developed with Sudan III.

On non porous surfaces the lip prints were better visualised on disposable plastic tumblers (Figure 7, 8), glass tumblers (Figure 9, 10), ceramic mugs (Figure 11, 12) than stainless steel tumblers (Figure 13, 14). The lip prints developed with Vermilion powder were better visualised than those developed with Sudan III on nonporous surfaces.

The lip prints could be appreciated more clearly on nonporous surfaces compared to the porous ones.



Fig. 1: Latent lip print developed by Vermilion on bond paper



Fig. 2: Latent lip print developed by Sudan III on bond paper



Fig. 3: Latent lip print developed by Vermilion on disposable paper cup



Fig. 4: Latent lip print developed by Sudan III on disposable paper cup



Fig. 5: Latent lip print developed by Vermilion on satin fabric



Fig. 6: Latent lip print developed by Sudan III on satin fabric

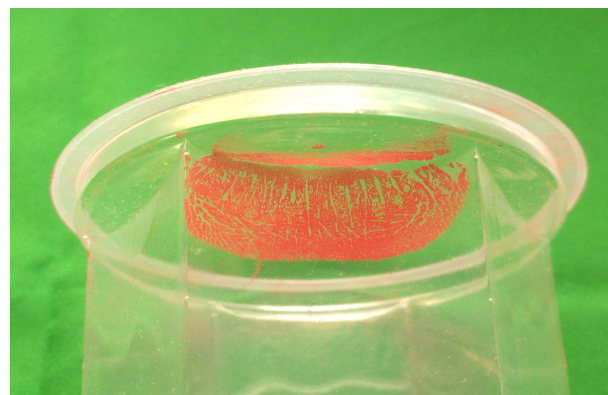


Fig. 7: Latent lip print developed by Vermilion on disposable plastic tumbler

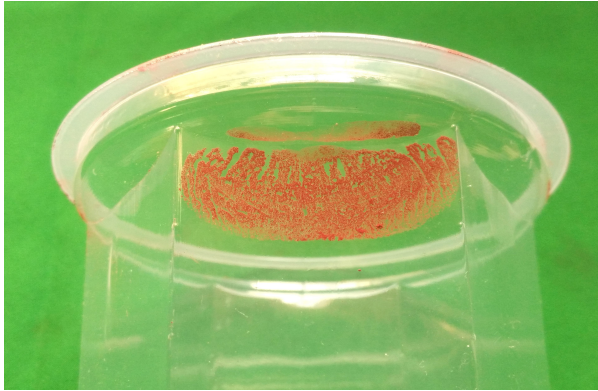


Fig. 8: Latent lip print developed by Sudan III on disposable plastic tumbler

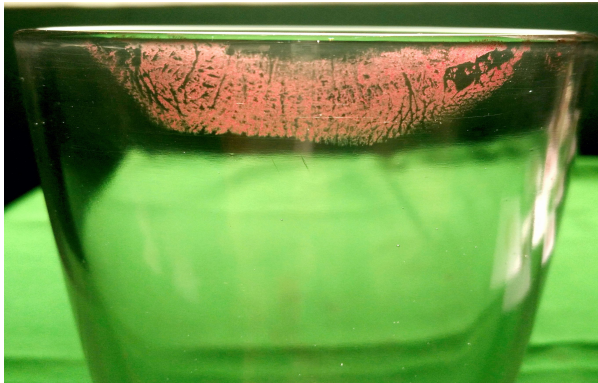


Fig. 9: Latent lip print developed by Vermilion on glass tumbler



Fig. 10: Latent lip print developed by Sudan III on glass tumbler



Fig. 11: Latent lip print developed by Vermilion on ceramic mug



Fig. 12: Latent lip print developed by Sudan III on ceramic mug



Fig. 13: Latent lip print developed by Vermilion on stainless steel tumbler

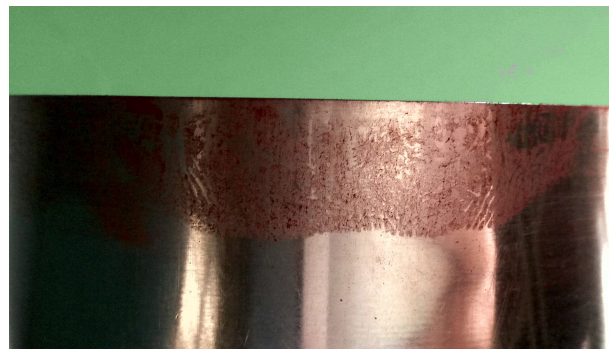


Fig. 14: Latent lip print developed by Sudan III on stainless steel tumbler

Discussion

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. A good quality developed latent lip print means that the lip outlines and lip grooves could be easily studied and classified. It depends on the surface on which the latent print is present and the reagent used to develop the print.

In the present study, on porous surfaces the latent lip prints were more clearly developed on bond paper

and disposable cup than white satin fabric. This could be due to greater absorbance of lipstick content by the satin fabric than the paper. Also, the paper has smoother surface than the fabric. Castello A et al compared the effectiveness of different lysochromes in developing latent lip prints on porous paper and cloth surfaces and found the quality of lip print development was better on fabric than on tissue paper [9]. In our study, the quality of lip prints developed by both the reagents on cigarette butts was poor. This could be due to the smaller surface area and curved surface of the cigarette butts on which there was overlapping of lip prints.

Amongst the nonporous surfaces the latent lip prints were more clearly developed on disposable plastic tumblers, glass tumblers, ceramic mugs than stainless steel tumblers probably due to surface finish of stainless steel. Disposable plastic tumblers, glass tumblers, ceramic mugs have smooth surfaces while stainless steel has a rough surface texture. Surface roughness of stainless steel is determined by the various lay patterns on its surface as determined by the manufacturer. These patterns could cause the powder particles to be entrapped in the surface crevices leading to lesser developed latent lip prints.

The lip prints were better developed on surfaces nonporous in nature by the physical powdering method because they did not absorb the oil content of the lipstick which the porous surfaces did, thereby, requiring better chemical means to be detected.

On both porous and nonporous surfaces Vermilion powder was better than Sudan III in developing latent lip prints. Sing NN et al compared the efficacy of Sudan black, Vermilion and indigo for developing lip prints on bone china cup, satin fabric and cotton fabric. They also found Vermilion and indigo to be better than Sudan black as it was free flowing and unlike Sudan black it did not adhere to the surface of the object where lipstick smear was not present [13].

Conclusion

Vermilion, an easily available natural dye has given comparable results in our study to Sudan III for development of latent lip prints. Sudan III has been categorised as Group 3 carcinogen by the IARC

(International Agency for Research on Cancer). More studies on use of different dusting powders based on surface characteristics of different materials, colour of background, detection method whether fluorescent or visual can be done to have better visibility of latent lip prints.

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