

# Cheiloscopy- An Important Technique in Forensic Science for Identification: A Review

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## Abstract

**Background:** The concept of lip prints is clear from previous literature review that this evidence can be used for forensic purpose. While accepting that a body of data existed regarding the individuality of lip pattern, there is no credible research on the stability of the lip detail over time. The timescale in question could be measured in weeks and months or years. The former would be used in police investigations and the latter can be used by geneticist.

**Keywords:** Forensic science, Forensic Odontology, Lip prints, Cheiloscopy.

## Introduction

Cheiloscopy, or lip print, is one of forensic methodology in case of identification. Lip prints are normal lines and fissures within the sorts of wrinkles and grooves present within the zone of transition of human lip, between the inner oral labial mucosa and outer skin or vermilion border<sup>1</sup>. Lip prints are exclusive for each individual and are considered as positive means of identification according to The Federal Bureau of investigation (F.B.I) and the Illinois state police<sup>2</sup>. Cheiloscopy (derived from the Greek word cheilos means lips) is that the forensic investigation technique that deals with identification of humans supported lip traces<sup>3</sup>.

## Review: Historical Background

The historical perspective of lip prints is that in 1902 an anthropologist named Fischer described

the furrows seen on the red part of human lips. In 1932 Edmond Locard, recommended cheiloscopy in identification. In 1950 Snyder mentioned lip prints are as individualistic because the ridge characteristics on fingers in his book 'Homicide investigation'. In 1967 Suzuki conducted investigations on the measurement of lips, use of rouge and therefore the method by which useful data might be obtained from it. In 1970 Suzuki and Tsuchihashi named the grooves on the labial mucosa (labiorum rubrorum) as 'sulci labiorum' and the lip prints as 'Figura linearum labiorum rubrorum'. In 1972 Mc Donell after studying lip prints in twins, reported that identical twins, are often distinguished by lip prints, although indistinguishable by all other means. In 1981 Cottone included in his book 'Outline of forensic dentistry' that lip prints are one among the specialized techniques utilized in identification. In 1990 Kasprzak after doing five-year research elaborated on the practical uses of cheiloscopy<sup>5</sup>.

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## Collection Methods in Cheiloscopy

The suspect's lips can be photographed for comparison. If the prints are on a flat surface like a mirror, then it can just be photographed as well and tracings can be made of the grooves. Another method is to ask the person to press their lips to a clean piece of paper or cellophane sheet after their lips are applied with lipstick or other medium, which can help to transfer the lip prints. Even without lipstick, the latent lip prints on a suitable surface can be obtained with a method similar to that used in obtaining fingerprints, where print developing powder or a magna brush and magnetic powder may be used. A number of different powders or cyanoacrylate can be used.

For many crime scene investigators, quite half the powder they use is regular, nonmagnetic powder. Regular powders are available in colours such as black, silver/grey, bichromatic and white. To record lip prints using the magna brush method, the person should impress his or her lips against a glossy porous surface or a smooth nonporous surface. The advantage of using magnetic powder and a magna brush is that, unlike the conventional brushes which tends to smear or leave streak marks on the print, these do not. These streaks may then be interpreted as false characteristics by the comparer. But magnetic powders and magna brush are costlier compared to that of conventional ones<sup>6</sup>. The development of latent successful latent lip prints experiment with reagents other than those traditionally used to develop fingerprints is required due to differences in print composition as published by before in the literature<sup>7,8</sup>.

A number of different developments lipochromes can be used during the analysis of latent print composition such as CI solvent black 3 (Sudan BlackB), CI solvent red 23 (Sudan III) or CI solvent Red 27 (Oil Red O). Lipochrome may be a generic term for compounds that have the power to dye fatty acids. Their molecular structure contains a portion that dissolves in contact with fat and another that is responsible for colour. To study the application of lipochromes the chemical composition of latent prints must be understood and this is the topic that has been widely studied. It is known that such prints contain lipids that do not depend on individual perspiration

levels, being more susceptible to development using dyes that react to lipids in contrast to ninhydrin which depends on perspiration levels. Past studies showed that lip prints taken with lipochromes, the most effective was CI Solvent black 3. A review on various methods of recording and collection of lip prints at the crime scene with development of latent lip prints has emphasized on photography, lip stick method, finger printer roller and magna brush (magnetic powder) method. It was suggested that the use of red part of lips to identify a human being are wider than it is commonly thought. Collection of visible as well as latent lip prints with a suitable transferring medium is important for its consideration as positive forensic evidence<sup>9,10</sup>.

The lips of the individual should be cleaned and a coloured lipstick is applied evenly with a single stroke on the vermilion border and asked to rub both the lips and spread the applied lipstick. After about 2 min, the glued portion of the cellophane tape should be placed over the lipstick. Lip prints should be obtained in the normal rest position by dabbing in the centre first and then pressing it comfortably towards the corner of the lips. The cellophane strip should then be stuck to a white bond for a permanent record then visualized through a hand glass or using computer aided software. The number of lines and furrows present on the middle part of the lower lip, their length, branching and combination should be noted. There are several instances where an erroneous lip print data may be obtained. Post mortem alterations tend to set in if the prints are not obtained within a day of death. The position of the lips changes depending on whether the mouth is kept open or closed. Well-formed lip prints are only available if the lips are closed. Lip print pattern is also subject to changes if affected by any pathology like mucocoeles. Debris on the lips, lack of support due to loss of anterior teeth or over smudging due to application of thick layer of lipstick can all lead to alterations in lip prints<sup>11,12,13</sup>. In studies regarding Post mortem changes in soft tissues reported that the physical changes of decomposition consist of alterations caused by accumulation of gases in the soft tissues as well as within the gastrointestinal and respiratory tracts. These changes are most prominent in the areas of the body which contain the most

blood, since the RBCs act as a food for the bacteria. Ordinarily, the soft tissues of the face swell first and cause eversion of lips which can make difficult for recording lip prints<sup>14,15</sup>.

When the lips are photographed, proper lighting should be focused on the lips at an angle that accentuates the contrast between the white and dark areas. The resulting Lip Print photographs should be of approximate natural size. This can be accomplished by placing a measuring device, ideally an ABFO scale No.2, or a ruler so that it will show in the photograph. Suzuki and Tsuchihashi in their study, obtained half sized negative film taken by Medical Nikkor (f 200 mm, lens 1: 5.6) and used for a contact print after enlarging to double size to get life size photographs. The photographic method involves photographing the Lip Print (either direct or latent and subsequently developed), and comparing it with photographs of the lips of the suspects or photograph of the Lip Print of the suspects. Photographing of the lips can often be very tricky and subject to errors as the central area of the lips and the angles of the lips are never in the same plane which leads to focusing errors resulting in unsharp or blurred or partial images of the lips. This invariably calls for recording the Lip Print and then photographing them and then comparing the two photographs. Thus, in spite of being a reliable method in other areas of forensics, in the recording of Lip Print images it adds to the cost but does not enhance the clarity in the same rising proportions. With the advent of digital photography, the trend is to record direct digital imaging using digital camera. Several courts particularly those in U.K. reject the evidence if the very first photograph is a direct digital image. On the grounds that there is no proof that the digital image has not been previously manipulated using any of the available digital imaging software including Adobe Photoshop. The court in U.K. insists on having the primary records based on conventional photographs and a willing to accept digital analysis of such photographs.

#### **Analysis of lip prints:**

Further studies has been done to classify lip prints, study their variations, determine the most common pattern in the study population, evaluate differences in lip prints between males and females

and between different age groups, ascertain whether there's any inheritance and thereby investigate their potential role in personal identification. The lip prints were analyzed using Adobe® Photoshop® software and classified consistent with Tsuchihashi classification. Patterns of lip prints occurred in diverse combinations. The patterns were similar between males and females and varied among different age groups. Some hereditary resemblance was observed between parents and offspring. Lip prints have a good potential for use in criminal investigations. They have been used only occasionally despite their frequent occurrence at crime scenes. A place for cheiloscopy is recommended within the scope of forensic odontostomatology, along with other means of forensic identification<sup>16,17,18,19</sup>.

#### **Concepts in cheiloscopy:**

Cheiloscopy reflects sharp implication and correlation with sign and symptoms of criminology. It has been noticed that criminals are still not much aware of this specialized method of criminal identification, which often makes them exposed to the court of law. In this connection detailed study of lip print will bear definite importance. Discussing these aspects, the study of such an important human anatomical presenting feature will open new horizons in today's rising criminal activities and medico legal disputes among the population.

Accordingly, it has been verified that lip prints do not change and recover after undergoing alterations like trauma, inflammation and disease like herpes or with environmental factors. It is interesting that the use of lip prints is not indispensable for leaving lip prints albeit the vermilion border has minor salivary glands and the edges of the lips have sebaceous glands with sweat glands in between. It is assumed that secretions of oil and moisture from these enable development of latent lip prints in most crime scenes where close contact between the victim and culprit has occurred. The main feature of dental identification is the existence of antemortem data which cannot be expected in Cheiloscopy as the only use of Cheiloscopy will be to relate lip prints to the lips that produced them<sup>20,21</sup>.

There are studies to ascertain whether lip prints behold the potential for determination of sex of an

individual. The lip prints obtained were coded, keeping in account the name and sex of the respective individuals. At the time of study, the sex of the print wasn't disclosed<sup>22,23</sup>.

In recent years, lipsticks used do not leave any visible trace after contact with the surfaces. They are characterized by their permanence and are referred to as persistent lip prints and can be lifted using the materials such as aluminium powder and magnetic powder. The importance of cheiloscopy in sex determination related to forensic investigation has been also discussed<sup>24,25</sup>.

It was overviewed that lines and furrows which are present on upper and lower lips and from one corner of mouth to other, only middle portion of lip is taken into account since this portion is always visible in any traces. It was also pointed out that it is not easy to position the lip prints in the general system of traces. Also, the use of lip sticks is not indispensable for leaving lip prints<sup>26,27</sup>.

The correlation of lip prints with blood groups may be a useful tool in forensic science for more accurate identification of an individual than with the use of lip print alone. There is no evidence to correlate lip prints with the blood groups in the literature but recently the studies has been done with the primary aim of determining the relationship between lip prints and blood group. It was found that there was no correlation between the blood groups and lip prints therefore no significant correlation exists between blood group and lip prints as lip prints play a vital role in identification because they are unique<sup>28,29,30</sup>.

### Conclusion

Cheiloscopy as a forensic investigation tool is gaining importance since previous couple of decades. Lip prints an important and emerging discriminatory tool in forensic criminology. If a definite description of the different parts of the upper lip and the lower lip is available for an individual by detailed study, this anti-mortem record can be used for matching the details of lip prints in post-mortem records for personal identification.

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