

## Review Article

# Cheiloscopy: A Vital Tool in Forensic Investigation for Personal Identification in Living and Dead Individuals

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**Received:** 29 July, 2020.  
**Revised:** 28 July, 2020.  
**Accepted:** 11 September, 2020.  
**Published:** 30 January, 2021.

## INTRODUCTION

The fissures appearing as wrinkles or grooves at the junction of the skin and inner labial mucosa of the lip combine to form lip prints, the study of which is known as cheiloscopy.<sup>[1,2]</sup> In crime scene investigation, the primary importance is given to the identity of a person based on the collection of certain characteristics of an individual, whether living or dead, decomposed, or mutilated.<sup>[3,4]</sup> These patterns on the lips are identifiable or visible in the 6<sup>th</sup> week of intrauterine life. Previous data report a scanty investigation technique for the identity of an individual in personal or crime scene investigation, however it can be valuable with certainty if extensive studies can be carried out.<sup>[4]</sup> Therefore, the present review article encompasses all the aspects of cheiloscopy which would be useful in personal identification in the living and deceased persons.

## ANATOMY OF LIPS

The upper lip lies between the nose and oral cavity, whereas the lateral lips are separated from the cheeks by nasolabial grooves, extending from the nose and passing approximately 1 cm lateral to the angles of the mouth. These grooves can

**ABSTRACT** Personal identification is a vital task in any crime scene investigation where there is a scarcity of biological evidences, and their chances of contamination and degradation are also high if they are not collected and preserved properly. However, cheiloscopy is one of the investigational techniques which rely on lip prints for human identification based on the anatomy and morphology of lips. Fischer in 1902 described the concept of grooves on upper and lower lips for the first time and later in 1932, it was recommended by Locard. Lip prints are considered very significant for personal identification and also prove to be an analogous to fingerprints. Moreover, lip prints do not change with time, therefore they could be useful for identification of a person, whether dead or alive. Due to the characteristic feature of uniformity throughout the life, these can be used to establish the presence or absence of a person in crime, provided that the person has left the lip marks on exhibits such as glasswares, clothing, tissues, and napkins. The scarcity of literature on cheiloscopic studies for personal identification shows that little research has been carried out so far within the forensic community. Previous cheiloscopic studies show that no study has been carried out to individualize a deceased person, which can be utilized in mass disasters apart from criminal cases. Therefore, the present review divulges the importance of cheiloscopy in the identification of living as well as deceased persons, which could be an innovative technique in the history of forensic science.

**KEY WORDS:** Cheiloscopy, forensic investigation, identification of deceased, personal identification

be easily observed while smiling. The philtrum present on the upper lip is an infranasal depression extending from the external nasal septum, separating the nostrils to the vermilion border which is the sharp demarcation between the colored edge of the lip and the surrounding skin. The lower lip lies between the mouth and the labiomental groove, which separates the lower lip from the chin. The upper and lower lips are continuous at the angles of the mouth or oral commissures.<sup>[5-7]</sup> The lips perform various functions such as eating, drinking, speaking, and emotional expressions, while sensory function for sensuality and sexuality is performed by a complex system of muscles and supporting structures which are denoted as classification of aging which states that:

- Class 1 (nice shape and definition): These individuals have a nice vermilion and vermilion border but wish for enhancement
- Class 2 (atrophic lips): These individuals have atrophic lips, which may be due to aging or heredity and are seeking augmentation to make them look more youthful

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**How to cite this article:** Kaushal A, Pal M. Cheiloscopy: A vital tool in forensic investigation for personal identification in living and dead individuals. *Int J Forensic Odontol* 2020;5:71-4.

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| Quick Response Code:<br> | Website: <a href="http://www.ijfo.org">www.ijfo.org</a> |
|                                                                                                             | DOI: 10.4103/ijfo.ijfo_15_20                            |

- Class 3 (lip atrophy and vermilion disappearance): The perioral lines are observed at the edge of the white roll of the lips where the orbicularis oris is attached to the dermis with no interposed fatty layer. These lines typically start at the 30s and increase in length and depth with aging. They may be more apparent with increasing sun exposure, smoking, lifestyle changes, and genetic predisposition.<sup>[8-12]</sup>

### CHRONOLOGICAL STUDIES OF LIP PRINTS

In 1902, Fischer first described grooves on upper and lower lips and later Locard in 1932 recommended cheiloscopy technique for individual identification and crime scene investigations. In 1950, Synder also described the importance of individuality of the lip grooves as a distinctive character just like ridge characters which are present on the fingerprints in his book entitled "Homicide Investigation." In 1967, Suzuki mentioned the practical application of extracting lip prints used in forensic science and later in 1970 Suzuki along with Tsuchihashi named the lip prints with grooves as *figura linearum labiorum rubrorum*. Besides, McDonell in 1972 studied the lip prints in identical twins and found that they were indistinguishable in every aspect, but their lip patterns were found to be different. In 1981, Cottone in his book, "Outline of Forensic Dentistry," mentioned cheiloscopy as one of the specific techniques for individualization. Moreover, Vahanwala also conducted a study on lip patterns to promote cheiloscopy in forensic science in 2000.<sup>[13-16]</sup>

### CLASSIFICATION

Santos in 1967 was the first to propose a classification of lip grooves as follows:

1. Straight line
2. Curved line
3. Angled line
4. Sine-shaped curve.

In 1970, Suzuki and Tsuchihashi gave a detailed classification of lip prints as follows:

- Type I – A clear-cut groove running vertically across the lip
- Type II – Partial length groove of Type I
- Type III – A branched groove
- Type IV – An intersected groove
- Type V – A reticular pattern
- Type VI – Other patterns.

### RENAUD CLASSIFICATION

It is considered the most well-developed classification. The lips are studied in left and right halves, and every groove according to its form has been given a number. This classification is based on the formula, in which capital letters are used to describe the upper left and upper right lip, for example, "L" is used for upper left lip and "R" is used for upper right lip. Further, small letters are used to classify each groove. Whereas in the lower lip, it is performed the other way round using capital letters to classify the grooves and small letters to separate left and right sides.<sup>[17-19]</sup>

Afchar-Bayat lip print classification: It is based on six groove types as follows:

- A1 – Vertical and straight grooves covering whole lips
- A2 – Like former but not covering whole lips
- B1 – Straight branched grooves
- B2 – Angulated branched grooves
- C – Converging grooves
- D – Reticular pattern grooves
- E – Other grooves.

Kasprzak gave classification based on individual features of line on red part of the lips as follows:

1. An eye
2. A hook
3. A bridge
4. A line
5. A dot
6. A rectangle like
7. A triangle like
8. A group of dots
9. A simple top bifurcation
10. A simple bottom bifurcation
11. A double eye
12. Crossing line
13. A closing bottom bifurcation
14. A delta-like opening
15. A simple opening
16. A closing top bifurcation
17. A pentagonal arrangement
18. A branch-like top bifurcation
19. A star-like bifurcation
20. A fence
21. A branch-like bottom bifurcation
22. A double fence
23. A hexagonal arrangement.

The classification system according to the macrostructure of lips can also be of immense importance to find the suspect by investigating agencies. This classification is based on the position of the individual, that is, front position (*norma frontalis*) and lateral position (*norma lateralis*). In *norma frontalis*, two parameters are identified, one in which the size of the lips is determined by measuring the maximum vertical dimension between the vermilion border and the oral fissure in both the upper and lower lips. The other is shape of the lips, which is determined by three factors such as oral fissure, upper vermilion border, and lower vermilion border.

In *norma lateralis*, lips are identified according to the protrusion with respect to each other and are classified as even lips, protruding upper lip, and protruding lower lip.

### COLLECTION OF LIP PRINTS

There are three types of lip prints found at the crime scene, which are visible lip prints (visible to unaided eye and do not need any further development for its visualization); latent or hidden lip prints (not visible to human eye and require further development processes for their visualization); and three-dimensional or plastic lip prints (found on soft, gel-like

surfaces and are visible to unaided eye but sometimes these lip prints need to be developed for photography).<sup>[20-22]</sup>

The search for lip prints at the crime scene needs a systematic approach, in which a magnifying lens is a very useful tool to locate and judge the presence of lip prints. They should be looked upon cutlery and crockery items, windows, glass doors, photographs, letters, etc., They can also be appearing along with tooth marks on food items. Observation done under white light will reveal latent lip prints which can be photographed without any further processing and then recorded for the proof. It can also be traced by holding flashlight at a low angle so that the surface can be observed at or under oblique light. Wherever possible, latent prints can be detected using episcopy coaxial illumination, in which lip prints are visible as dark ridges against light background.

The lip prints can be developed by powder method, which is used to develop prints on nonporous surfaces such as glass, marble, metal, plastic, and finished wood. The powders commonly used are aluminum powder, magnetic powder, and plumb carbonate powder. Another method is chemical method, which is commonly used by crime scene investigators to locate the print. It is performed by using iodine fuming, thereafter it must be photographed quickly as the print fades rapidly. Moreover, silver nitrate is used on the impressions left on the cardboard or paper-like surfaces; ninhydrin reacts with oils present in the latent print and gives bluish prints and lysochrome dyes and small particle reagent are the other chromogenic agents which are used to impart color to the developed print. The last method is X-ray method, which employs lead powder on the suspected surface, which is then X-rayed and then the photographic film is developed to obtain the prints. Other methods used to collect lip prints on the multicolored surfaces are Sudan Black reagent method, which can be applied directly to the print, yellow fluorescent powder method, and Nile red reagent method.

Lip prints can also be collected from the suspect by photographing the suspect's lips or by applying the lipstick/lip rouge or other transferable medium so that it can be obtained on paper or cellophane tape or it can be obtained on a nonporous surface such as mirror which can be photographed and enlarged and hence, overlay tracings can be made.<sup>[23-25]</sup>

## DISCUSSION

The rise in the criminal cases per day has made lip prints an indispensable tool for forensic scientists to punish the culprits. The lip prints can look similar in two different individuals, but their intersection, branching pattern, and reticulation will be different from one another. In various studies, lip prints were found to be unique and have been accepted as a valuable tool in identification. However, in various crime scenes lip prints are available on various living and non-living things they are not effectively evaluated. The practice of lip print analysis can be considered inconsistent worldwide due to failure of a strong argument for reliability. Moreover, there are scanty evidence of cheiloscopy on deceased persons. The literature available on the study of lip prints on living individuals suggests that there is a need for practicing lip print analysis

in a dead person, which can aid in crime scene investigation. Besides, the development of lip print technique on deceased persons would also serve to establish the identity of dead persons in case of mass disasters. In the study done by Gazge *et al.* and Ranjan *et al.*, it was found that a red or dark pink shade of lipstick on a white bond sheet gave the best results. They also scanned the lip prints and studied with the help of ADOBE PHOTOSHOP 7 CS5 for digital analysis. The software enlarged the working area and made possible to scan photographs and overlap images for forensic identification. It was found that the digital method not only identified the images of lip prints but also it helped in storing the data of the study individuals. Despite the evolving technology, very few studies have been conducted on lip print analysis by digital method which is absolutely unexplored for forensic scientists or forensic odontologists, as evident by the availability of meticulous data on manual detection rather than the use of advanced technology.<sup>[26,27]</sup>

## CONCLUSION

On the basis of an extensive review of literature, it has been found that the analysis of lip print on deceased persons in today's digital era is in infant stage. Therefore, the present review article has been focused on the historical development of lip print for the individualization of living persons along with its acceptability among the scientific community. Moreover, as no such relevant practice has been carried out by forensic scientists on the identification of lip prints on deceased individuals, the importance of the practice of advanced technology with the use of digital methods has also been highlighted in the present article. It would possibly serve as an opportunity for forensic odontologists to perform lip print examination as a key procedure in the identification of dead bodies whether available at the crime scene or in case of mass disasters.

## FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

## CONFLICTS OF INTEREST

There are no conflicts of interest.

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