

Cheiloscopy as a Tool for Human Identification

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Abstract

Establishing a person's identity can be a very difficult process. Dental, fingerprint and DNA comparisons are probably the most common techniques used in this context, allowing fast and secure identification processes. However, since they cannot always be used, sometimes it is necessary to apply different and lesser known techniques. One such technique is cheiloscopy. It is known that due to their special features, lip grooves can be used successfully in human identification. This paper attempts to review the techniques of cheiloscopy, and describes the different classifications and their limitations.

Keywords: Cheiloscopy; Lip prints; Human identification.

Introduction

Identification of an individual, living or dead is based on the theory that all individuals are unique. Personal identification is becoming increasingly important not only in legal medicine but also in criminal investigation. Cheiloscopy is a forensic investigation technique that deals with the identification of human based on the lip prints.

Like fingerprint, the lip-print pattern has recently proven to be unique for each individual. The analysis of the lip prints left at a scene of a crime (on cups and cigarette butts), and their comparison with those of the suspected person might be an important tool for identification and is often considered the key in solving a crime.^{1,2,3}

Cheiloscopy

Cheiloscopy, (from the Greek words cheilos= lips, e skopein=, see) is the name given to the lip print studies.^{4,5,6} The importance of cheiloscopy is linked to the fact that lip prints

are unique to one person, except in monozygotic twins.^{4,7,8,9}

Like fingerprints and palatal rugae, lip grooves are permanent and unchangeable.⁴ It is possible to identify lip patterns as early as the sixth week of in uterine life. From that moment on, lip groove patterns rarely change, resisting many afflictions, such as herpetic lesions. In fact, only those pathologies that damage the lip subtract like burns, seem to rule out cheiloscopic study¹⁰.

Historical review

Anthropologists first noted the biologic phenomenon of systems of furrows on the red part of human lips. R. Fischer was the first to describe it in 1902.⁴ In 1932, Edmond Locard, one of France's greatest criminologists, acknowledged the importance of cheiloscopy.¹¹ In 1950, Le Moyer Snyder, in his book "Homicide Investigation", mentioned the possibility of using lip prints in the matter of human identification.¹² Later, Santos, in 1960, suggested that the fissures and the criss-cross lines in the lips could be divided into different groups (simple and compound) and each group could be further divided into eight subtypes.¹³

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In the period 1968-1971 two Japanese scientists, Tsuchihashi and Suzuki^{14, 15} examined 1364 persons at the Department of Forensic Odontology at Tokyo University. Based upon that research it was established that the arrangement of lines on the red part of human lips is individual and unique for each human being. Two years later, Tsuchihashi and Suzuki and developed another study which resulted in a new classification for lip prints. This study, made over a long period of time, enabled the authors to confirm not only lip print singularity, but also lip response to trauma; in fact, these authors observed that after healing, the lip pattern was equal to that before the injury occurred.^{14, 16}

Anatomical aspects

Lips are highly sensitive mobile folds, composed of skin, muscle, glands and mucous membrane. They surround the oral orifice and form the anterior boundary of the oral cavity. There are two different kinds of lip covering – skin or mucosa. When the two meet, a white wavy line is formed – the labial cord – which is quite prominent in Negroes. Where identification is concerned, the mucosal area holds the most interest. This area, also called Klein's zone¹⁰, is covered with wrinkles and grooves that form a characteristic pattern – the lip print.⁴

However, this is not the only area that deserves careful study. In fact, in cheiloscopy, one should also analyse lip anatomy, considering their thickness and the position. The lips can be horizontal, elevated or depressed and, according to their thickness; it is possible to identify the following four groups¹⁰:

- (1) Thin lips (common in the European Caucasian)
- (2) Medium lips (from 8 to 10 mm, are the most common type)
- (3) Thick or very thick lips (usually having an inversion of the lip cord and are usually seen in Negroes) and

- (4) Mix lips (usually seen in Orientals).

Lip print classification

Martín Santos classification¹³

This author divides the lip grooves into two groups:

Simple

When they are formed only by one element; this element can be a straight line (R-1), a curve (C-2), an angular form (A-3) or sinusoidal (S-4);

Compound

When they are formed by several elements; in this case, they can be bifurcated (B-5), trifurcated (T-6) or anomalous (An-7).

Suzuki and Tsuchihashi classification¹⁶

These authors considered six different types of grooves, as seen in Table 1.

Type I: Clear cut grooves running vertically across the lip.

Type II: The grooves fork in their course.

Type III: The grooves intersect

Type IV: The grooves are reticulate

Table 1. Suzuki and Tsuchihashi lip prints classification

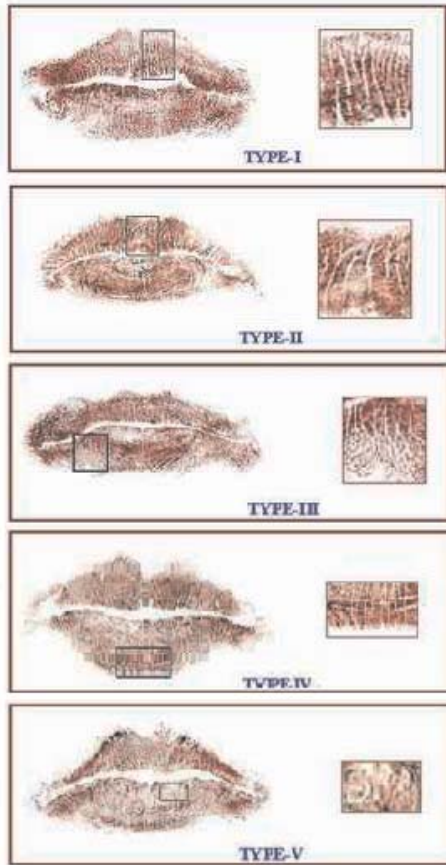
| Classification | Groove type |
|----------------|---------------------|
| Type I | Complete vertical |
| Type I' | Incomplete vertical |
| Type II | Branched |
| Type III | Intersected |
| Type IV | Reticular pattern |
| Type V | Irregular |

Type V: The grooves do not fall into any of the type I to IV (morphologically undifferentiated)

Renaud classification¹⁰

This is, probably, the most complete classification. The lips are studied in halves (left and right), and every groove, according to its form, has a number (Table 2). A formula

Fig 1. Different types of lip prints (Yasuo Tsuchihashi)

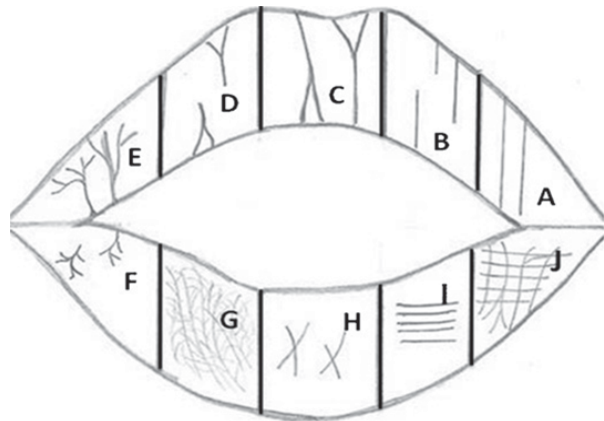


is then elaborated using capital letters to describe the upper lip left (L) and right (R) sides, and small letters to classify each groove; in the lower lip, it is done the other way around, using capital letters to classify the grooves, and small letters to separate left from right sides.

Table 2. Renaud lip prints classification

| Classification | Groove type |
|----------------|----------------------------------|
| A | Complete vertical |
| B | Incomplete vertical |
| C | Complete bifurcated |
| D | Incomplete bifurcated |
| E | Complete branched |
| F | Incomplete branched |
| G | Reticular pattern |
| H | X or coma form |
| I | Horizontal |
| J | Others forms (ellipse, triangle) |

Fig 2. A diagram showing the lip-groove types



- A=complete vertical
- B=incomplete vertical
- C=complete bifurcated
- D=incomplete bifurcated
- E=complete branched
- F=incomplete branched
- G=reticular pattern
- H=X or comma form
- I=horizontal
- J=horizontal with other forms (vertical, bifurcate or branching).

*Afchar-Bayat classification*¹⁰

This classification, dated from 1979, is based on a six-type groove organization, as seen in Table 3.

Table 3. Afchar-Bayat lip prints classification

| Classification | Groove type |
|----------------|---|
| A1 | Vertical and straight grooves, covering the whole lip |
| A2 | Like the former, but not covering the whole lip |
| B1 | Straight branched grooves |
| B2 | Angulated branched grooves |
| C | Converging grooves |
| D | Reticular pattern grooves |
| E | Other grooves |

*Jose' Maria Dominguez classification*¹⁰

This is a classification based on the one made by Suzuki and Tsuchihashi. In the grooves classified as Type II of Suzuki and Tsuchihashi, the author and his co-workers observed, with some frequency, a slight variation: they observed that branched grooves often divided upwards in the upper lip, and downwards in the lower, as reported by Suzuki and Tsuchihashi; but they also realise that some grooves, the so called III type branched the other way around.

Analyzing and recording lip prints

Searching for prints in a crime scene investigation can be very important in establishing the true nature of the facts.^{5, 17, 18} Lip prints can link a subject to a specific location if found on clothes or other objects, such as glasses, cups or even cigarettes' butts.¹⁹

Sometimes lip prints will be seen as lipstick smears. Lipsticks are complex substances, which have in their constitution, several compounds, oils or waxes. The color of the lipsticks is due to organic inks and inorganic pigments.²⁰

However, all lip prints are important, even the ones that are not visible. In fact, this complex process is not restricted to studying visible prints, but also the latent ones. The vermilion border of the lips has minor salivary and sebaceous glands which, together with the moisturizing done by the tongue, leads to the possibility of the existence of latent lip prints.^{10, 17}

When searching for lip prints, one must always consider that not all lipstick smears are colored; in fact, in recent years the cosmetic industry has been developing new lipsticks which do not leave a visible smear or mark when they come in contact with different items – these are called persistent lipsticks.²¹

The identification of latent print evidence is often considered the key in solving a crime.²² A group of Spanish investigators has studied these latent lip prints and concluded that they

could be studied in a similar way to fingerprints, using similar techniques.^{6, 19, 20, 21} In fact, even when located on "difficult" surfaces (such as porous or multicolored ones), latent prints can be easily seen using fluorescent dyes.¹⁰

When dealing with lip prints from persistent lipsticks, one must always remember that persistent lipsticks have minimal oil content and therefore, their development using conventional powders might not be effective. Lysochromes should then be used since they have the ability to dye fatty acids and are very effective when used on long-lasting lipstick prints, even on porous surfaces.¹⁸

In this manner, latent lip prints should always be considered when processing a crime scene, even if there are no traces of lipstick. Processing lip prints depends on the anatomical, morphological and histological tissue features of lips. Observation should be the first step when processing lip prints, using white and ultraviolet light sources.^{10, 23}

Photographs should be made prior to any processing in order to protect the evidence. Photographing latent prints is a complex process that obeys a strict methodology. According to FBI guidelines, latent prints should be photographed individually with an identification label and a scale; each step in the processing sequence must be photographed.²³

If lipstick is present, the lipstick itself should be analysed in order to determine its constitution. About 65% of lipsticks share the same ingredients, however some are different and this difference can provide the identification of the lipstick manufacturer.¹⁹

Lip prints can be recorded in a number of ways. If located on a non-porous surface, lip prints can be photographed and enlarged. Using transparent overlays, it is possible to make an overlay tracing.^{10, 17} In some circumstances, lip prints can be covered with substances allowing direct observation and photography.¹⁰ As previously referred to, the development of lip prints can be made using several substances, such as aluminium

powder, silver metallic powder, silver nitrate powder, plumb carbonate powder, fat black aniline dyer or cobalt oxide.^{19, 21} All lip prints contain lipids which make their development possible by using lysochromes dyes (Sudan III, Oil Red O, Sudan Black). Sometimes, the use of fluorescent reagents is necessary^{19, 24} especially when the color of the developer and the color of the surface on which the lip print lies are the same, or when the lip print is an old brand.^{24, 25}

Plumb carbonate is a white powder which can be used as a developer with a brush, over smooth, polished, metallic or plastic surfaces. Its only limitation is its use over white surfaces. In such circumstances, marphil black powder or fat black aniline dyer are better choices since they both have a dark colour.¹⁰ Silver nitrate can lead to positive results on non ideal surfaces, such as untreated wood or cardboard . DFO (1,8-Diazafluoren-9-one) and ninhydrin are chemical developers also used on porous surfaces . On plastic or waxed surfaces, or on vinyl gloves, using cyanoacrylate dye is a good choice. In photographs, latent prints can be developed using cyanoacrylate dye or an iodine spray reagent.^{10, 22}

Lips may also be studied and recorded in order to allow a proper comparative analysis. Although lips can be photographed directly, covering them with lipstick allows better groove visualization¹⁰ The lip prints should be recorded, making several recordings until all transfer mediums are exhausted. Then, prints are covered with transparent overlays and, when using a magnifying lens, a trace can be successfully done.

Limitations of recording and analyzing the lip prints

1. As the lip print is produced by a substantially mobile portion of the lip. So the same person can produce different-shaped lip prints according to the pressure, direction and method used in taking the print.¹⁷

2. Lip prints are affected by the type of lipstick used. The red or brown, non-glossy,

non-metallic lip stick convey clear lip print, while the glossy or the metallic lip sticks bring apparently good prints but their photographs are luminous and not clear for examination. Persistent lipsticks do not leave visible smears or marks when they come in contact with different items.¹⁰

3. Existence of some pathological conditions (lymphangiomas, congenital lip fistula, lip sclerodermia, Merkelson-Rosenthal syndrome, syphilis, lip cheilitis, among others), can invalidate the cheiloscopy study.¹¹

4. Lip prints from cadavers may get affected with post-mortem changes. Utsuno *et al.*²⁶ have studied these changes and concluded that a satisfactory identification rate was achieved. However, this study was carried out under a laboratory environment and what happens to lip prints obtained from cadavers exposed to the natural environment is still not known.

5. Also, due to the lack of antemortem data referring to lip prints, it is difficult to perform a comparative study where necroidentification is concerned. Therefore, the only use of cheiloscopy will be to relate lip prints to the lips that produced them.^{27, 28, 29,30,31}

6. The habits of people in different localities should be respected in analyzing lip prints as it could affect the shape of the print. In areas where males usually have moustache, it is occasionally difficult to determine the philtrum in male prints. This would be a character in the print that could help identifying a person.

Conclusion

Cheiloscopy possesses the possibility of assisting the forensic field in identifying a suspect should be pursued and, if discovered pertinent, utilized in the act of criminal investigations and legal proceedings. The use of lip prints falls into this category and because they have been proved reliable and trustworthy to link a suspect to a crime, more emphasis should be given to this field. Lip print

analysis is a process that provides both qualitative and quantitative results thus its application in the forensic field should be widely accepted by both law enforcement and the legal professionals.

Cheiloscopy helps to relate lip prints to the lips produced them. Research suggests the conclusive evidence that lip prints are suitable for the successful comparison, analysis and identification of a person to a crime.

Research studies and information regarding the use of lip prints as evidence in personal identification and criminal investigation in forensic dentistry are very much scanty, but exist as a methodology in forensic dentistry. Studying in depth and establishing further facts and truth in lip prints will certainly help as useful evidence in forensic dentistry.

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