

Original Article

Establishing Role of Cheiloscopy in Person Identification and Sex Determination

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ABSTRACT

Background: The study of lip prints (LP) is known as Cheiloscopy. Every individual has a unique lip print pattern. Thus it can act as an important tool for person identification in civil and criminal cases. **Objective:** The aim of this study is to ascertain whether the uniqueness of LP can help in identifying a person, to evaluate the varied lip patterns among males and females and its usefulness in gender discrimination. **Materials and methods:** A cross-sectional study was conducted on 80 undergraduate students (40 males and 40 females) of Hazaribagh Dental College aged between 18 to 24 years. The lipstick was applied evenly on both the lips and then the LP was collected. Later these lip patterns were analyzed and interpreted. **Results:** 35 out of 40 LP of females and 36 out of 40 LP of males were correctly matched. Type I and I' were predominantly seen in females while type IV and V patterns were more common among males. A total of 73 of 80 subjects were identified correctly by this method. **Conclusion:** The result suggests that the uniqueness of LP in forensic dentistry can be explored for law implementation by determining gender and person's identity.

Keywords: Cheiloscopy, Forensic dentistry, Lip prints, Sex determination.

Forensic science is defined the application of scientific methods and techniques to matters under investigation by a court of law. Forensic science in a broad sense deals with criminal investigations by identification of the body, cause, and manner of death, etc [1]. Person's identification plays a significant role in the forensic investigation. Various parameters like fingerprinting, DNA testing, examination of blood, body fluids, and hair are used for the purpose of identification [2-3]. Nevertheless, in some particular instances related to criminal cases, other material evidence can also be available that help in human identification. This data can be obtained from soft oral and perioral tissues, such as lips and palate which can assist in person's identification as they are biologically unique for every individual [4]. Study

of lines and fissures which are seen as wrinkles and grooves over the human lip is known as cheiloscopy [5-6]. It can act as an essential tool in forensic odontology.

The lip patterns can be identified as early as the 6th week of intrauterine life and do not change over time [4]. It is unique for every individual, even in twins and family relatives. Therefore it can be explored in revealing personal identity as it has been proved that they recover after minor trauma, inflammation and resist even herpetic infections [7-8]. Lip prints can act as important evidence in verifying a person's identity as in cases like sexual assault, murders or rape many times the subject unknowingly leaves it on clothes, cups, glasses, cigarette butts or on the skin [9-10]. Thus lip prints can build up a chain in linking crime, suspect, and the crime scene.

The present study was performed to ascertain whether the configuration of lip prints behold the potential in determining the identity and sex of an individual.

MATERIALS AND METHODS

The present cross-sectional study was conducted in the Department of Oral Pathology and Microbiology, after obtaining approval from the Institutional Ethical Committee. All the subjects were formerly informed about the purpose and objective of the study and a signed informed consent form was obtained from all. A total of 90 healthy undergraduate students (45 males and 45 females) of Hazaribagh Dental College with age range between 18 to 24 years were randomly selected for the study. Subjects with any kind of malformation, deformity, inflammation, trauma, and scars on the lips were excluded from the study. People either sensitive or allergic to lipsticks were also excluded from the study. Lip impression of all the subjects was collected. 10 samples (5 males and 5 females) were rejected because of smudging and poor quality of LP. Thus a total of 80 subjects were qualified to be enrolled in the study.

Materials used in the study was cotton and saline, disposable lip applicator, dark red colored frosted lipstick (Maybelline no 906), thin bond paper, cellophane tape, magnifying lens, a pen for labeling, EPSON flatbed scanner, and a personal computer with Adobe photoshop CS software for analyzing the scanned images.

METHOD OF COLLECTING LIP IMPRESSION

The upper and lower lips were first cleansed with cotton using normal saline followed by application of the lipstick evenly on both the lips with the help of a disposable lip applicator, starting from midline and moving laterally as suggested by Sivapathasundharam (2001) in his study [2]. The subjects after rubbing both the lips carefully allowed them to dry for two minutes so that the lipstick may spread uniformly over the entire vermilion border. The first lip impression was made on a strip of cellophane tape which was then stuck to a white thin bond paper for the purpose of making a permanent record and to analyze it later using a magnifying lens. **(Figure 1)** Each lip print was coded with a unique number without revealing the name and sex of the subject to the examiners. Each Lip print was then scanned using an EPSON image scanner set at a resolution

of 600 dpi and stored in TIFF (Tagged Image File Format). The middle part of both the lip was considered for classification as it was clearly recorded in almost all the samples and also because of the characteristic superiority of lines and grooves seen in this area.

FOR SEX DETERMINATION

The LP collected was classified following the classification scheme proposed by Suzuki and Tsuchihashi as shown in table 1[11].

Table 1 - Suzuki and Tsuchihashi's classification for lip print

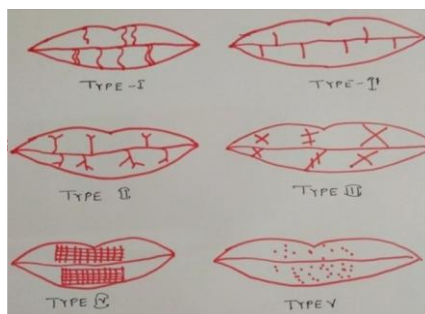
Type I	Clear-cut vertical grooves running across the entire lip
Type I'	Similar to type I, but not covering the entire lip
Type II	Branched groove pattern.
Type III	Intersected groove pattern
Type IV	Reticular groove pattern.
Type V	Grooves not falling into any of the above category i.e. undetermined

Determination of sex of an individual was done as per the description given by Vahanwala *et al.* [6,12] Type I, I': Pattern dominant in female Type II: Pattern dominant in female Type III: Pattern present in male Type IV: Male Type V: Male (varied pattern). Different patterns in all quadrants suggest male sex and same patterns in all quadrants suggest female sex. All the lip prints of the 80 subjects were submitted to the examiner but numbered with a unique code but without disclosing the subject's identity for sex determination.

FOR PERSON IDENTIFICATION

After one month second lip print was recorded in a similar manner and both the lip prints were scanned. Using Adobe Photoshop CS software, the first lip print was inverted digitally and the transparency of second lip print was increased by 50%. Then the second lip print was overlapped over the first one and grooves were matched [13] **(Figure 3)**.

The data obtained was tabulated and submitted for statistical analysis using SPSS (statistical package for social sciences) version 20 and Chi-square test. The P value of <0.05 was considered significant.



Figures: Figure 1 - Lip print of a male subject, Figure 2 - The pattern of lip prints as suggested by Suzuki and Tsuchihashi, Figure 3 - Second lip print was overlapped over the first one using adobe photoshop software

Table 2 - Lip print pattern among males and females

Lip print pattern	Male	Female
Type I	1	16
Type I'	2	14
Type II	2	6
Type III	5	1
Type IV	17	1
Type V	13	2
Total	40	40

Chi-square= 49.191; df=5; $p < 0.001$; Highly significant

Table 3- Determination of gender by lip print pattern

Gender	Determined	Undetermined
Male	36	4
Female	35	5

$r = 0.775$; $p < 0.001$; Highly significant

Table 4 - Person identification by evaluating lip print pattern

Number of Subjects (n=80)	Identified	Unidentified
Male n = 40	36	4
Female n = 40	37	3

$r = 0.800$; $p < 0.001$; Highly significant

RESULTS

In our study, every lip print was biologically unique and no two lip patterns were similar to each other. Secondly, Type I, I' was the predominant pattern followed by type II while Type III, IV and V were the least common patterns among females. Similarly, Type IV and V patterns were predominant among males followed by Type III while Type I, I' and II were least commonly observed in males. (Table 2) On comparing the lip patterns in both the

genders, a chi square value of 49.19 with 5 degrees of freedom and a p-value of < 0.001 was obtained.

A total number of 36 males and 35 females were recognized correctly by their lip prints with Pearson's correlation coefficient (r) value 0.775. (Table 3) This indicates a perfect correlation between the lip print pattern and sex determination for males and females of the study group. Out of 80 subjects, 73 subjects were correctly identified which include 36 males and 37 females with r value 0.800. (Table 4) This indicates a perfect correlation between the lip pattern and person's identification among the males and females of the study group.

DISCUSSION

Forensic science plays a significant role in both civil and criminal investigation for identification of individuals who are either missing, victims or culprits hiding their identity. Cheiloscopy refers to a forensic investigation technique dealing with identification of humans based on their characteristic lip traces. The pattern of wrinkles or grooves on the lips is individualistic characteristics like fingerprints and they resist many afflictions and hence LP can aid as a tool in human identification [14]. The lip print pattern can be identified as early as the sixth week of intrauterine life.

The presence of furrows on the red portion of the human lip was first described by Fisher [15] in 1902, though later it has been classified by several people in various ways. The first person who recommended the use of LP was a criminologist from France, Edmond Locard (1932). Later in 1967, Dr. Martins Santos classified LP based on the pattern of lip grooves [13]. He divided it into four types; 1) Straight line, 2) Curved line, 3) Angled line

and 4) Sine-shaped curve. Another widely accepted classification of LP was proposed by a Japanese doctor Suzuki in 1970, who classified it into five types as mentioned above in Table 1[11]

Lip print can act as additional evidence as it can be easily collected from the crime scene from clothing, cups, glasses, cigarette butts, windows, and doors [5] Even the F.B.I. and the Illinois State Police consider that LP is individualistic like fingerprints and thus can be explored as positive means of person identification.[16]. The present study was undertaken to find out the variations in lip patterns among 80 individuals. It was an attempt to analyze whether the LP holds the potential for determination of sex and identity of an individual. Although lines and furrows are found throughout the vermillion border, but as stated by the previous researchers, the middle portion of the lip is readily visible in all the cases.

On LP analysis, in the present study, none of the Lip patterns were identical. The result was in accordance with the study conducted by Tsuchihashi and Suzuki, and by various other authors [6,11,14,15]. Several studies conducted by various authors reported that type I and type I' lip patterns were dominant in females while type III, IV and V were dominant in males [6,14,15]. The present study also reported similar results where type I and type I' patterns were predominantly seen in females while type IV and type V were dominant in males. In addition, we also reported that type II and type III patterns, though were less common, but were also seen in females and males respectively. Few authors have reported that similar type lip pattern in all four quadrants is common in females whereas males show different patterns in different quadrants in a same individual [15-16].

CONCLUSION

The present study suggests that the lip prints behold the potential in recognizing the sex and identity of an individual. The use of LP in criminal cases is limited and since the credibility of lip prints is yet not firmly established in our courts, a study in larger cohorts is strongly recommended.

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