

# Identification of sex using lip prints : A clinical study

Vivek Sharma, Navin Anand Ingle, Navpreet Kaur, Pramod Yadav

Department of Public Health Dentistry, Kanti Devi Dental College and Hospital, Mathura, Uttar Pradesh, India

Corresponding author (email: <kasturivivek@yahoo.co.in>)

Dr. Vivek Sharma, Department of Public Health Dentistry, Kanti Devi Dental College and Hospital, Mathura, Uttar Pradesh, India.

## Abstract

**Aim:** To determine the sex of an individual from the configuration of lip prints. **Materials and Methods:** This study was conducted on 200 first to final year BDS students of K. D. Dental College and Hospital, Mathura, Uttar Pradesh, India. All the subjects (females = 100, males = 100) belonged to the age group of 17–26 years. Non-glossed lip stick color, white bond paper, cellophane tape, scissors, and magnifying lens were used for identification. Length and thickness of the upper and lower lips were measured with sliding calipers. For all the lip prints, the thickness of the lip was measured at the center of the lip. **Results:** Overall accuracy by the examiner was found to be 81% (out of 200 participants, 162 were diagnosed correctly) and distribution of lip patterns showed a statistically significant difference between the genders ( $P \leq 0.05$ ). For the upper lip, the average difference in lip thickness found between males and females was 3.8 mm. However, the average difference for the lower lip between males and females was 2.9 mm. **Conclusion:** In the present study, the lip prints of the subjects did not match with each other. The study reveals that lip prints behold the potential of determination of the sex of the person.

**Key words:** *Cheiloscopy, lip prints, sex*

## INTRODUCTION

For crime investigation, person identification is significant. Fingerprint system was first used in India in 1858 by Sir William Herschel. Today, identity can be established by a combination of methods, which makes the identification process relatively flawless. Similar to fingerprints, the pattern of wrinkles on the lips also has individual characteristics. Lip prints are unique and do not change during the life of a person. Numerous elevations and depressions that form a characteristic pattern on the external surface of lip are referred to as lip prints. Lip prints are easily obtained at the crime scene from various materials such as clothing, cups, glasses, cigarettes, doors, etc.<sup>[1]</sup> They also possess

furrows that can be classified into various types for identification of an individual.<sup>[2]</sup>

In 1902, R. Fischer, an anthropologist, first described the biological phenomenon of systems of furrows on the red part of human lip. Use of lip prints in personal identification and criminalization was first recommended by Edmond Locard.<sup>[3]</sup>

The idea of using lip print for identification was suggested by Synder in 1950. He proved in an investigation that the characteristics of lips formed by lip grooves are as individually distinctive as the ridge characteristics of finger prints. Until 1950, however, anthropology merely mentioned the existence of the furrows on the lip prints.<sup>[2]</sup>

Two Japanese scientists, Y. Tsuchihashi and T. Suzuki (1968–1971), carried out a research on 1364 persons at the Department of Forensic Odontology at Tokyo University. It was established that the arrangement of lines on the red part of human lips is individual and unique for each human being.<sup>[4]</sup>

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### Classification of lip prints (Suzuki and Tsuchihashi, 1970)

The lip prints are classified as follows:

Type I- A clear-cut groove running vertically across the lip

Type I'- Partial-length groove of Type I

Type II- A branched groove

Type III- An intersected groove

Type IV- A reticular pattern

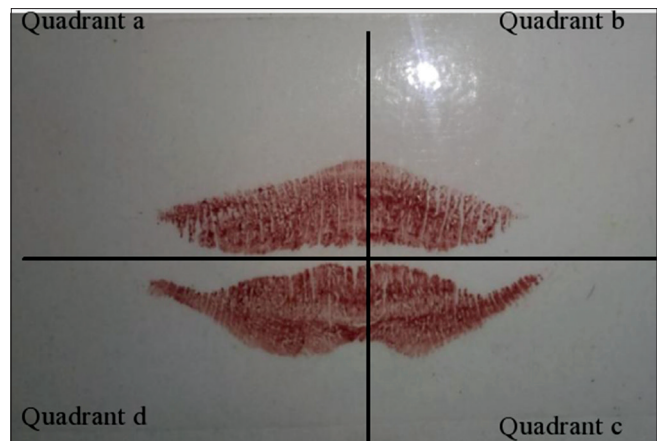
Type V- The grooves do not fall into any of the types I–IV and cannot be differentiated morphologically. Types I, I', and II are predominant in females and types III, IV, and V in males.<sup>[5]</sup>

### MATERIALS AND METHODS

The study population consisted of 200 first to final year BDS students of K. D. Dental College and Hospital, Mathura, Uttar Pradesh, India. All the subjects (females = 100, males = 100) belonged to the age group of 17–26 years. Ethical clearance for conducting the study was obtained from the ethical committee of K. D. Dental College prior to the start of the study. Before data collection, the purpose and procedure of the study were thoroughly explained to the subjects. Also, a written informed consent was obtained from each subject. Those students who were present at the time of study and who were free from any lesions on their lips were included in the study. Subjects with any lip anomalies or any lesions on the lips, those with any known allergy to lip stick, and those who were not willing to participate were excluded from study.

Dark-colored, non-glossy, less moisture containing lip stick was used to obtain the lip prints of the subjects. After cleaning the surface of the lip, the lip stick was taken on a swab and uniformly smeared on the lip. The lip stick was allowed to settle for a minute, after which a transparent cellophane tape slightly larger than the thickness of the lip was uniformly and gently applied to the lip from right to left.

The tape was removed in one swing and stuck to an A4 paper. All the lip prints were collected by one assistant who coded all the prints and kept in record the name and sex of the respective individual. However, the sex of lip prints was not disclosed to the examiner, so as to reduce the errors while interpreting the results of the study. The pattern of lip prints was studied quadrant wise [Figure 1] by using a magnifying lens by one examiner. Patterns of lip prints were classified according to the classification given by Suzuki and Tsuchihashi.



**Figure 1:** Lip print division quadrant wise

The results obtained were later on verified from the coded data collected by the assistant.

The length and thickness of the lips were measured using standard sliding calipers. Measurements for the upper and lower lips were carried out separately. Length of the lip was measured between the outermost visible points on the lip print at the angle of the mouth. Thickness of the lip was measured for the upper and lower lips in the midline.

All the data were analyzed using SPSS (version 22). Chi-square test was used to analyze the lip print patterns in this study. The level of significance considered was  $P \leq 0.05$  for the study.

### RESULTS

In our study, 78% male lip prints and 84% female lip prints were diagnosed correctly by the examiner [Figure 2]. Overall, 162 (81%) were diagnosed correctly and 38 (19%) were diagnosed wrong [Figure 3].

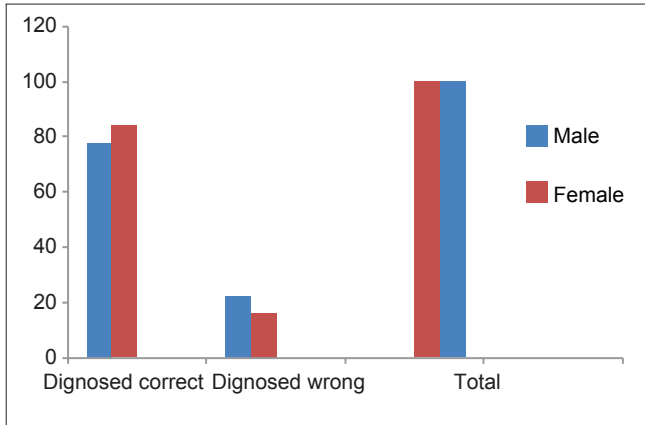
The most common lip patterns found in males were Type III and Type IV (20% each), followed by Type V (18%), Type I' (12%), Type I, Type II, and mixed type (10% each), as compared to females where the commonest patterns were Type I and Type I' (25% each), followed by Type II (17%), Type III and Type IV (10%), mixed type (8%), and Type V (5%). When the lip print patterns were compared, a statistically significant difference was found between males and females ( $P \leq 0.05$ ) [Table 1].

The most common types of lip prints observed in males were as follows: Quadrant a, Type III (8%); quadrant b, Type IV (5%); quadrant c, Type IV (5%); and quadrant d, Type III and Type V (5% each) [Table 2].

**Table 1: Distribution of lip print pattern types in both males and females**

Gender	Lip patterns as described by Tsuchihashi and Suzuki (%)						
	Type I	Type I'	Type II	Type III	Type IV	Type V	Mixed type
Male*	10	12	10	20	20	18	10
Female	25	25	17	10	10	5	8
Total	35	37	27	30	30	23	18

*P* ≤ 0.05, Mixed = Combination of more than one type of lip prints, \* = Statistically significant



**Figure 2:** Accuracy of gender determination by the examiner

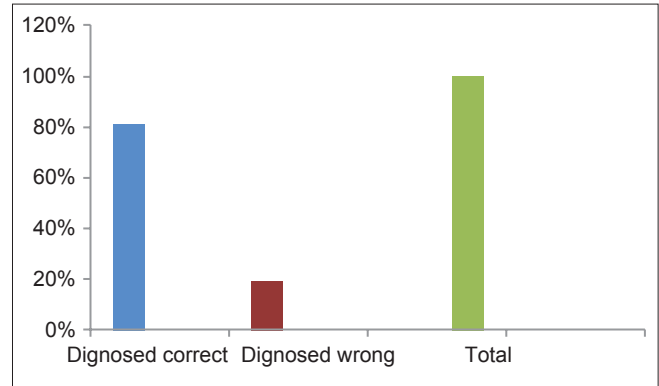
The most common types of lip prints observed in females were as follows: quadrant a, Type I (8%); quadrant b, Type I' (8%); quadrant c, Type I (7%); and quadrant d, Type I, Type I', and Type II (4% each) [Table 3].

Regarding the thickness of lip prints in males, the average thickness of the upper lip was 13.3 mm as compared to 9.5 mm in females; the average difference between males and females was 3.8 mm for the upper lip. The maximum and minimum thicknesses of the upper lip in males were found to be 18.9 mm and 12.5 mm, respectively. In females, the maximum and minimum thicknesses of the upper lip were found to be 14.6 mm and 7.0 mm, respectively.

The average thickness of the lower lip in males was 14.0 mm as compared to 11.1 mm in females, and the average difference between males and females was 2.9 mm for the lower lip. The maximum and minimum thicknesses of the lower lip in males were 16.9 mm and 11.5 mm, respectively. In females, the maximum and minimum thicknesses of the lower lip were 15.4 mm and 6.9 mm, respectively.

## DISCUSSION

Cheiloscopy has been proven to be a reliable technique to establish the correct identity of a person. Absence of population-specific and gender-specific data can hamper



**Figure 3:** Overall accuracy of cheiloscopy in gender determination

its application as evidence. Hence, analysis and testing of such data in various population groups has become absolutely essential.

In our study, 78% males and 84% females were diagnosed correctly by the examiner, in comparison to a study done by Dongarwar *et al.*<sup>[6]</sup> in which 80% males and 90% females were diagnosed correctly.

Overall, in our study, out of 200 participants, 81% participants were diagnosed correctly, compared to the studies of Bajpai *et al.*<sup>[3]</sup> and Sharma *et al.*<sup>[7]</sup> in which 73.7% and 90% participants were diagnosed correctly, respectively. This proves that cheiloscopy is a unique method for identification of sex.

In the present study, the most common lip print patterns found in males were types III and IV (20% each). This is in contrast to the study conducted by Ghimire *et al.*<sup>[8]</sup> in which Type I pattern was the most common among males and in the study of Malik *et al.*,<sup>[9]</sup> Type IV and Type V patterns were most common in males. However, the studies conducted by Arif *et al.*,<sup>[10]</sup> Sheetal *et al.*,<sup>[11]</sup> and Kautilya *et al.*<sup>[5]</sup> showed that the most common patterns found in males were types IV, V, and III, respectively. However, the most common lip patterns found in females examined in the present study were Type I and Type I' (25% each). Similarly, Malik and Goel<sup>[9]</sup> also reported that Type I and Type I' were the most common patterns in females, while in

**Table 2: Quadrant wise distribution of different types of lip prints in males**

S. no.	Quadrant a (%)	Quadrant b (%)	Quadrant c (%)	Quadrant d (%)
Type I	3	2	3	2
Type I'	4	3	4	1
Type II	3	2	2	3
Type III	8	4	3	5
Type IV	7	5	5	3
Type V	5	4	4	5
Mixed type	2	4	1	3

**Table 3: Quadrant wise distribution of different types of lip prints in females**

S. no.	Quadrant a (%)	Quadrant b (%)	Quadrant c (%)	Quadrant d (%)
Type I	8	6	7	4
Type I'	7	8	6	4
Type II	5	5	3	4
Type III	4	2	2	2
Type IV	3	3	2	2
Type V	1	1	2	1
Mixed type	2	3	1	2

the study done by Kautilya *et al.*,<sup>[5]</sup> the most common pattern found was Type I (30%). In the study conducted by Kapoor and Tiwari,<sup>[12]</sup> Type III pattern was most frequently present in both males and females.

A statistically significant difference ( $P \leq 0.05$ ) in lip print patterns between males and females was found in the study done by Xu *et al.*<sup>[13]</sup> and Gondivakar *et al.*,<sup>[14]</sup> which is in accordance with our study.

In our study, Type III was the most common in quadrant a among males and types I and I' were the most common in quadrants a, b, and c among females. In the study done by Amith *et al.*,<sup>[1]</sup> Type I' was the most predominant pattern in the first and second quadrants. However, in the study conducted by Verghese *et al.*,<sup>[15]</sup> Type IV pattern was found to be the most predominant pattern in the middle portion of the upper lip.

The present study revealed the average thickness of the upper lip was 13.3 mm as compared to 9.5 mm in females. The average thickness of the lower lip in males was 14.0 mm as compared to 11.1 mm in females. A difference of about 3.8 mm in the lip thickness of upper lip and about 2.9 mm in the lip thickness of the lower lips between males and females were seen. Male

lips were found to be thicker as compared to female lips. Also, in the study conducted by Kautilya *et al.*,<sup>[5]</sup> similar results were obtained. Male lip prints were thicker than female lip prints and this finding could be helpful to differentiate the sexes.

Limitations of the study were that since the lip print was produced with a substantially mobile portion of the lip, the same person can produce different lip prints according to the pressure, direction, and method used in taking the print. Also, the amount of lip stick used can affect the print. The existence of some pathological conditions (lymphangiomas, congenital lip fistula, syphilis, lip cheilitis, etc.) can invalidate the cheiloscopy study.

## CONCLUSION

Using the lip print pattern for identification of a person is one of the unique practices. The patterns of lip prints showed significant sexual dimorphism between males and females. Male lips were found to be thicker as compared to female lips in our study. This criterion of difference in thickness could be effectively used to differentiate the sexes. Therefore, lip print pattern can be used as one of the weapons for personal identification of an individual.

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