

# A study of morphological patterns of lip prints in relation to gender of North Indian population

Shalini Gupta<sup>1</sup>, Khushboo Gupta<sup>2</sup>, OP Gupta<sup>3</sup>

<sup>1</sup>Head, <sup>2</sup>Senior Resident, Department of Oral and Maxillofacial Pathology, Chhatrapati Shahuji Maharaj Medical University (Erstwhile King George Medical College), Lucknow, India, <sup>3</sup>Assistant Professor, Department of Surgery, Career Institute of Medical Sciences and Hospital, Lucknow, India.

## ABSTRACT

**Background:** Establishing a person's identity is a very important process in civil and criminal cases. Dental, fingerprint and DNA comparisons are probably the most common techniques allowing fast and secure identification processes. However, in certain circumstances related to the scene of the crime or due to lack of experienced personnel, these techniques might be unavailable; so there is still an increasing need for reliable alternative methods of establishing identity.

**Objective:** The objective of the study was to check for any peculiar lip patterns in relation to the sex of the individual and determine the most common lip patterns in the given population.

**Materials and Methods:** This study was conducted on 150 subjects, which included 75 males and 75 females, in the age group of 18–30 years. After applying lipstick evenly, the lip print of each subject was obtained on a simple bond paper by a researcher, and later the lip print was then analyzed and interpreted.

**Results:** The intersected type was most commonly seen in females and branched in males. Reticular pattern was the least common type in both males and females.

**Conclusion:** This study shows that the lip prints are unique to an individual and behold the potential for recognition of the sex of an individual.

**Keyword:** Lip prints.

## INTRODUCTION

The professional obligation of dental surgeons to mankind is not only to serve in examination, investigation, diagnosis and treatment of oral and orofacial lesions of local origin, and oral manifestations of systemic diseases, but also to serve in other community services and legal matters.<sup>1</sup> Nevertheless, in some particular circumstances, often related to a criminal investigation, there can be other data, which are important to the process of human identification. Some of these data result from soft oral and perioral tissue prints. In fact, the lips, as well as the hard palate, are known to have features that can lead to a person's identification. The study of lip prints is known as *cheiloscopy*.<sup>2</sup>

Cheiloscopy (from the Greek words *cheilos* meaning 'lips' and *e skopein* meaning 'to see') is the name given to the lip print studies.<sup>3</sup> The importance of cheiloscopy is

linked to the fact that the lip prints are unique to one person, except in monozygotic twins.<sup>4</sup> Like fingerprints and palatal rugae, the lip grooves are permanent and unchangeable. It is possible to identify the lip patterns as early as the 6th week in uterine life.<sup>2</sup> From that moment on, the lip groove patterns rarely change, resisting many afflictions, such as herpetic lesions. Analysis of the lip prints left at a scene of crime, and their comparison with those of the suspected person may be useful for identification.<sup>5</sup>

## HISTORICAL BACKGROUND

This biological feature was first described by Fisher in 1902; however, it was only in 1930 that Diou de Lille developed some studies which led to lip print use in criminology.

Renaud, in 1972, studied 4000 lip prints and confirmed the singularity of each one, supporting the idea of lip print singularity.<sup>6</sup> Two years later, Suzuki and Tsuchihashi developed another study which resulted in a new classification for lip prints.<sup>7</sup>

Studies regarding lip prints are rather few in spite of their possible prominent help as useful evidence in forensic medicine. If unique, it seems that a great effort should be made to record the lip prints of all individuals in a certain location so as to establish a database that might be of great value in civil and criminal issues. Hence, the aim of this research was to study the lip prints of different individuals in different parts of the lip and find out the incidence of any particular pattern in the given age group.

## MATERIALS AND METHODS

A total of 150 individuals were included in the study, comprising 75 males and 75 females, in the age group of 18–30 years. The subjects having full dentition were included. However, the eruption of the last molar was ignored in classifying as full dentition, as its eruption is variable. Lips free from any pathology, having absolutely normal transition zone between the mucosa and the skin were included in the study. Subjects with malformation, deformity inflammation trauma and surgical scars (e.g. operation for cleft palate) and other abnormalities of the lips were excluded because of their unsuitability for this investigation. Consent of all the individuals was obtained for the study.

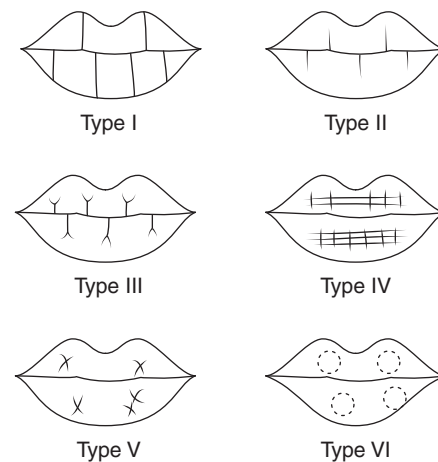
In order to classify the lip prints in this study, the classification scheme proposed by Suzuki and Tsuchihashi<sup>7</sup> was used: Type I—clear-cut groove running vertically across the lip, Type II—partial length groove, Type III—branched groove, Type IV—intersected groove, Type V—reticular pattern, Type VI—other patterns<sup>7</sup> (Figure 1).

Red and brown colored lipstick, cellophane tape, white chart paper and magnifying lens were used to analyze the lip prints, where red lipstick was used for females and brown for males. Lips of the subjects were cleaned and they were asked to open the mouth when lipstick was applied in a single motion. They were asked to gently rub the lips together to spread the lipstick evenly and to make a lip impression in the normal rest position of the lips by dabbing it in the center first and then pressing it uniformly toward the corners of the lips. The cellophane strip was then stuck to the white chart paper for permanent record purpose and then the recorded lip prints were visualized by magnifying lens. While studying the various types of lip prints, each individual's lips were divided into 4

compartments, i.e. 2 compartments on each lip, and were allotted the digits 1–4 in a clock-wise sequence starting from the subject's upper right.

## RESULTS

A total of 150 individuals were included in the study, comprising 75 males and 75 females each, in the age group of 18–30 years. On analysis, 2 cases each from the male and female samples were excluded due to smudging of the impression in 1 compartment, so they were not included in the study. Hence, a total of 73 cases of males and 73 females were analyzed. In the overall study, no individual had single type of lip print in all the 4 compartments and no 2 or more individuals had similar type of lip print pattern. When the overall pattern was evaluated among all the lip compartments of the study subjects, it was found that intersecting pattern was most common in females having 27.7% whereas branching pattern was common in males having 28.1% (Table 1). However, the least common was



**Figure 1** Photograph showing all the patterns of the lip prints followed in this study.

**Table 1** Lip print patterns in males and females

Lip print pattern (n = 73 × 4)	Males (n [%])	Females (n [%])
Vertical	43 (14.7)	42 (14.4)
Branched	82 (28.1)	75 (25.7)
Intersected	66 (22.6)	81 (27.7)
Reticular	38 (13.0)	42 (14.4)
Undetermined	49 (16.8)	42 (14.4)
Poor quality	14 (4.2)	10 (3.4)

the reticular pattern seen in 13% males and 14.4% females (Table 1). The intersecting pattern was found to be most common among the upper lips of both males and females (Table 2). The branching pattern was found to be most common among the lower lips of both males and females. The analysis of the lip print type in each compartment was done. Among males, it was found that the intersected pattern was most common in compartments 1 and 2 having 26% and 23%, respectively, whereas branching was common in compartments 3 and 4 having 35% and 32%, respectively, while the least common pattern in lip compartments 1, 2 and 4 was the reticular pattern having 6.8%, 9.6% and 16.4%, respectively (Table 2). However, in compartment 3, males showed intersected pattern as the least common (16.4%). On evaluation of the lip prints of the females, compartments 1 and 2 exhibited intersected pattern predominantly having 37% and 27%, respectively. However, in compartments 3 and 4, branched pattern was commonest (%). Lip compartments 1, 2, 3 and 4 of the females showed the reticular pattern as the least common having 8.2%, 13.7%, 19.2% and 16.4%, respectively (Table 2).

**Table 2** Lip print patterns in each lip compartment of males and females

Lip compartment	Lip print pattern	Males (n=73×4 [%])	Females (n=73×4 [%])
1	Vertical	10 (13.7)	7 (9.6)
	Branched	16 (21.9)	15 (20.5)
	Intersected	19 (26.0)	27 (37.0)
	Reticular	5 (6.8)	6 (8.2)
	Undetermined	19 (26.0)	16 (21.9)
	Poor quality	4 (5.5)	2 (2.7)
2	Vertical	8 (11.0)	11 (15.1)
	Branched	16 (21.9)	13 (17.8)
	Intersected	17 (23.3)	20 (27.4)
	Reticular	7 (9.6)	10 (13.7)
	Undetermined	22 (30.1)	17 (23.3)
	Poor quality	3 (4.1)	2 (2.7)
3	Vertical	13 (17.8)	10 (13.7)
	Branched	26 (35.6)	25 (34.2)
	Intersected	12 (16.4)	16 (21.9)
	Reticular	14 (19.2)	14 (19.2)
	Undetermined	5 (6.8)	5 (6.8)
	Poor quality	3 (4.1)	3 (4.1)
4	Vertical	12 (16.4)	14 (19.2)
	Branched	24 (32.9)	22 (30.1)
	Intersected	18 (24.7)	18 (24.7)
	Reticular	12 (16.4)	12 (16.4)
	Undetermined	3 (4.1)	4 (5.5)
	Poor quality	4 (5.5)	3 (4.1)

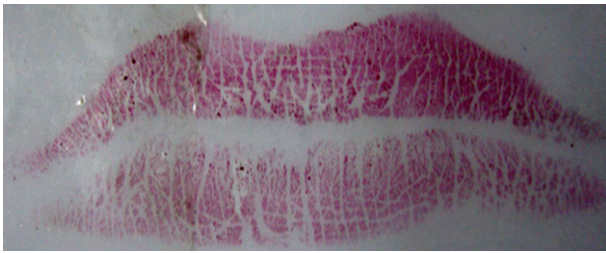
## DISCUSSION

Lip prints are very useful in forensic investigation and personal identification. They are considered most important forms of transfer evidence, and are analogous to fingerprints. Lip prints are usually left at crime scenes, and can provide a direct link to the suspect. In recent years, lipsticks have been developed that do not leave any visible trace after contact with surfaces such as glass, clothing, cutlery or cigarette butts. These lip prints are characterized by their permanence and are, therefore, referred to as 'persistent' lip prints. Although invisible, these prints can be lifted using materials such as aluminum powder and magnetic powder.<sup>8</sup> The use of lipsticks is not indispensable for leaving lip prints. The edges of the lips have sebaceous glands, with sweat glands in between. Thus, secretions of oil and moisture from these enable the development of 'latent' lip prints, analogous to the latent fingerprints.<sup>9</sup>

Sharma et al have emphasized the historical basis of lip prints by stating that the lip prints were first described by Fisher in 1902; however, it was only in 1930 that de Lille developed some studies which led to lip print use in criminology. Most important contribution came from Thomas and Van Wyk, who mentioned that it was Edmond Locard, one of France's greatest criminologists, who recommended the use of lip prints in human identification. Snyder in his book *Homicide Investigation*, written as early as 1950, mentions the possible use of lip prints in the identification of individuals. Suzuki and Tsuchihashi proposed a classification dividing the pattern of grooves on the lip into 6 types and also named the wrinkles and groove visible on lips as 'sulci labiorum rubrorum'.<sup>10</sup>

The study of lip prints for the interpretation in forensic odontology is scanty in the literature. To elaborate further study, to record facts and truth for personal identification and criminalization, this research has been aimed to study on lip prints in depth. Keeping the classification given by Suzuki and Tsuchihashi as the basis, this study was conducted to study the lip prints of different individuals in different parts of the lips, to establish facts so as to aid in giving further details of the lip prints.

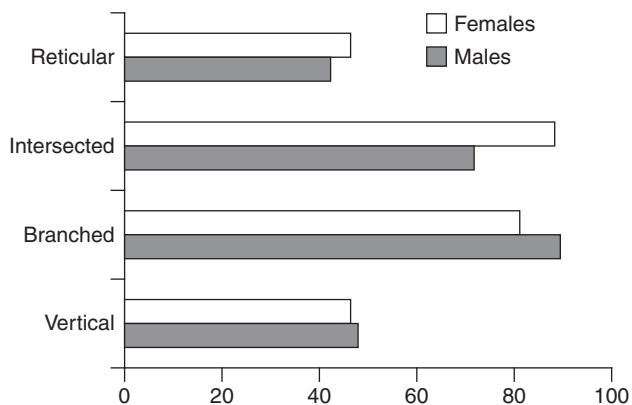
In our study, it was found that intersecting pattern was most common in females, 27.7% (Figure 2) whereas branching pattern was most common in males, 28.1% (Figure 3). Our study is in accordance with that of Saraswathi et al<sup>11</sup> and Sivapathasundharam et al.<sup>6</sup> The analysis of the lip prints among different compartments of males and females showed that the intersected type was most common in 1 and 2 while branched in 3 and 4. Further analysis showed that the least common was reticular in 1 and 2 in both males and females. Interestingly, the intersected type was least in



**Figure 2** Photograph showing the lip print of a female subject.



**Figure 3** Photograph showing the lip prints of a male subject.



**Figure 4** Bar graph representing the morphological pattern incidence in males and females.

3 and 4 compartments of males (Figure 4). However, females exhibited the vertical pattern to be least in compartments 3 and 4. These results do not coincide with the study done by Saraswathi et al.<sup>11</sup>

One common problem that is encountered during the cheiloscropy studies is that of smudging or spoiling of lip prints. Due to this major problem, two cases were excluded from the study group. In our study, 7.5% of all the lip prints were spoiled and were of poor quality and 31.2% were of unidentifiable marks. This was more in males in comparison with females.

Further detailed examination of these lip prints would be required to establish identity, if found matching at this level. Evidence such as photographs, cigarette butts,

drinking glasses, cups, letters, window panes and other items that could bear lip prints should be closely examined. A trace of this kind carries a huge amount of information which can be used in the reconstruction of the events, establishing versions checking them and identifying suspects. The lip prints have some limitations like trauma, pathologies, surgical treatment can affect the size and shape of the lip. The zone of transition close to vermilion border is extremely mobile; so the prints produced may differ depending on the pressure applied and its direction.

Cheiloscropy is a relatively new field among the large number of identification tools available to the forensic expert. Work on this subject has already elicited useful information such as that the lip prints are unique to an individual and can be used to fix the identity of a person, that they remain stable over time and that the lip prints show gender differences.<sup>12</sup>

## CONCLUSION

With regard to sex, lip prints vary from males and females in the given age group and no similarity was seen between any compartments. Further work on the subject can help to make cheiloscropy a practical reality at the ground level of the forensic identification process.

## REFERENCES

1. Utsuno H, Kanoh T, Tadokoro O, Inoue K. Preliminary study of post mortem identification using lip prints. *Forensic Sci Int* 2005;149:129–32.
2. Caldas IM, Magalha T, Afonso A. Establishing identity using cheiloscropy and palatoscopy. *Forensic Sci Int* 2007;165: 1–9.
3. Molano MA, Gil JH, Jaramillo JA, Ruiz SM. Estudio queiloscópico en estudiantes de la facultad de odontología de la Universidad de Antioquia. *Rev Fac Odontol Univ Antioquia* 2002;14:26–33.
4. Neville B, Damm D, Allen C, Bouquot J. *Oral and Maxillofacial Pathology* 2nd edn. Philadelphia: WB Saunders, 2002:763–74.
5. Ehara Y, Marumo Y. Identification of lipstick smears by fluorescence observation and purge-and-trap gas chromatography. *Forensic Sci Int* 1998;96:1–10.
6. Sivapathasundharam B, Prakash PA, Sivakumar G. Lip prints (Cheiloscropy). *Ind J Dent Res* 2001;12:234–7.

7. Suzuki K, Tsuchihashi Y. A new attempt of personal identification by means of lip print. *Can Soc Forensic Sci J* 1971; 4:1548.
8. Satyanarayana NK, Prabhu A, Nargund R. Forensic odontology: cheiloscropy. *Hong Kong Dent J* 2011;8:25–8.
9. Sharma P, Saxena S, Rathod V. Cheiloscropy: the study of lip prints in sex identification. *Forensic Dent Sci* 2009;1: 24–7.
10. Sharma P, Saxena S, Rathod V. Comparative reliability of cheiloscropy and palatoscopy in human identification. *Ind J Dent Res* 2009;20:453–7.
11. Saraswathi TR, Gauri M, Ranganathan K. Study of lip prints. *J Forensic Dent Sci* 2009;1:28–31.
12. Vahanwalla SP, Parekh BK. Study on lip prints as an aid to forensic methodology. *J Forensic Med Toxicol* 2000;17: 12–8.