

## ORIGINAL ARTICLE

# A Comparative Analysis of Quadrants-Wise Distribution of Lip Print Pattern in Both Genders

Sunil,<sup>1</sup> Singh S,<sup>2</sup> Tyagi S,<sup>3</sup> Chouksey VK,<sup>4</sup> Rani M,<sup>5</sup> Duchania SK.<sup>6</sup>

Senior Resident,<sup>1,2</sup> Assistant Professor,<sup>3,4,6</sup> Director Professor and Head.<sup>5</sup>

1,2,3,5. Department of Forensic Medicine and Toxicology, Lady Hardinge Medical College & Associated Hospitals, New Delhi.

4. Department of Forensic Medicine and Toxicology, ABV Government Medical College, Vidisha.

6. Department of Forensic Medicine and Toxicology, Noida International Institute of Medical Sciences, Greater Noida.

## Abstract :

Lip prints from the crime scene and those collected from suspects may be useful in the determination or narrowing down of the investigation. The present study was undertaken to classify lip prints determine the most common pattern in four quadrants of lip in the study population and evaluate differences in lip prints between males and females thereby investigating their potential role in personal identification. The study was conducted on 200 subjects of which 100 were males and 100 were females. Lip prints were obtained using lipstick and adhesive tape. Our study showed a statistically significant relationship between Type I' lip print in the left lower quadrant and Type I' & Type II lip print in the right lower quadrant with the sex of the individual. Additional research on the lip print pattern is needed to expand the field of forensic anthropology and benefits law enforcement organizations. The variation of the lip print pattern in the four quadrants can aid in personal identification and sex differentiation among populations

**Keywords :** Cheiloscopy, Sex determination, Personal identification, lip quadrants.

## Introduction :

As early as the sixth intrauterine week, lip prints, which are naturally occurring lines, fissures in the form of wrinkles, and grooves, can be identified. Multiple studies have demonstrated that lip print patterns are distinctive and remain uniform or rarely change with age, climatic variations, after minor trauma, and consequently their presence on the articles can be used to confirm the presence or absence of a person from the crime, provided there has been consumption of beverages, drinks, usage of cloth, tissues or napkins, etc. at the crime scene, and useful in a Forensic investigation for personal identification.<sup>1-3</sup> Lip prints detected at a crime scene on items such as cups, glasses, cigarettes, windows, doors, and clothes may therefore be collected and further analyzed to give crucial evidence as like fingerprints, there are no two people with identical lip prints.<sup>4,5</sup>

Lip prints are believed to be similar to fingerprints, and the procedures used for the study of lip prints are simpler to perform and are useful in criminal investigations when other identification methods or criteria are either unavailable or difficult to evaluate.<sup>6</sup> Thus visible or latent lip prints discovered at a crime scene can be developed, documented, and compared with the prints of suspects to identify the donor.<sup>7</sup> As a result, it is reasonable to believe that lip prints can be included in the forensic sciences arena as a valid technique for identifying persons of

interest associated with criminal activity.<sup>8</sup>

The current study was carried out with the aim that the results of the study will be useful for Forensic experts, police personnel, and other law enforcement agencies since Forensic medicine experts must actively participate involved in various objectives of crime scene investigation from where lip prints can be taken and used for suspect identification. The results of the analysis of lip prints in the present study will be valuable for the identification of suspects from the scene of a crime, especially when conducting autopsies on unknown or unidentified bodies or when only mutilated or fragmentary remains of head and face are retrieved.

## Materials and Methods :

The study was conducted on a population of 200 (100 males and 100 females of permanent residents of the New Delhi district) subjects between the age of 18-30 years. Individuals with any diagnosed congenital abnormality, trauma, malformation, deformity, mucocoele, cicatrization and surgical scars of the lips were excluded from the study. Microscopic glass Slides, cello tape, magnifying glass, dark coloured, non-persistent, nonglossy, matte lipstick, white (A4 size-built Copy power 75 gsm) papers, tissue paper, cleansing oil, cleansing oil were used in this study.

## Methodology :

After taking the consent and explaining the procedure to the subjects at least five lip prints were collected by applying a thin layer of lipstick on the clean, dry slightly separated lips uniformly. The subjects were instructed to rub both lips to spread the applied lipstick. Cello tape was applied from the right side to the left side covering the entire length and breadth of upper and lower lips from the glued side very carefully so that smudge

## Corresponding Author

**Shashank Tyagi**

Email : shankstag011@gmail.com

Mobile No. : +91 7738922308

## Article History

DOR : 01.05.22; DOA : 07.11.22

marks would not appear. This cello tape was carefully removed and then applied to the white paper sheet. The five lip prints were so obtained to take into account variations in the appearance of lip prints owing to the pressure difference and thus displaying sufficient characteristics for examination. The lip prints were studied carefully using a magnifying glass in bright light to identify the type of lip print.

The lip was divided into four topographic areas (each lip was divided into two areas) and each area was studied alone to determine the type of the grooves. This was done by drawing a perpendicular line passing through the midline dividing each lip into left and right quadrants. Therefore, each lip print was divided into the following four areas; right upper quadrant (RUQ), left upper quadrant (LUQ), right lower quadrant (RLQ) and left lower quadrant (LLQ) as shown in Figure no. 1.

The classification of the type of lip prints depends on the maximum number of grooves present in that area. The classification of the type of lip prints depends on the maximum number of grooves present in that area. Various classification systems were given by researchers over the period of time, however, the most accepted classification is given by Tsuchihashi<sup>9</sup> after considering six different types of grooves as shown in table no. 1. Institutional ethics committee approval was obtained before the study.

### Results :

The most common type of lip prints in RUQ, LUQ, RLQ, and LLQ on 100 male were Type II i.e 27%, 25%, 23%, and 26% respectively, while on 100 females were Type I' i.e 28%, 25%, 32% and 29% respectively as shown in table no. 2.

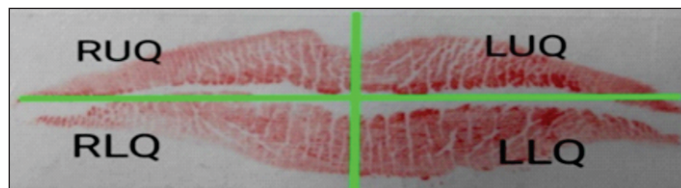
No statistically significant difference ( $P > 0.05$ ) was observed

**Table no. 1: Classification of lip prints pattern.**

Classification	Groove type
Type I	A clear-cut line or groove running vertically across the lip
Type I'	Straight grooves that disappear halfway into the lip instead of covering the entire breadth of the lip or partial-length groove of Type I
Type II	Grooves that fork in their course or a branched groove.
Type III	An intersected groove
Type IV	A reticular groove
Type V	Grooves that do not fall into any of the above categories and cannot be differentiated morphologically.

**Table 2: Comparison of lip print pattern distribution in RUQ, LUQ, RLQ and LLQ in both gender**

	RUQ		LUQ		RLQ		LLQ	
Pattern type	Males %	Females %	Males %	Females %	Males %	Females %	Males %	Females %
I	15%	18%	15%	19%	18%	26%	17%	25%
I'	22%	28%	20%	25%	17%	32%	16%	29%
II	27%	14%	25%	14%	23%	18%	26%	16%
III	14%	10%	16%	8%	12%	2%	10%	5%
IV	13%	16%	13%	18%	14%	7%	14%	7%
V	9%	14%	11%	16%	16%	15%	17%	18%
Total	100%	100%	100%	100%	100%	100%	100%	100%



**Figure:1 Distribution of quadrants of the lip.**

**Table 3: Comparison of visible lip print pattern in males and females in Right and Left upper quadrant**

Sex					Chi-Square Test						
Type	Female		Male			Chi-square		DF		p-value	
	Frequency										
	RUQ	LUQ	RUQ	LUQ	RUQ	LUQ	RUQ	LUQ	RUQ	LUQ	
I	18a	19a	15a	15a	7.179a	8.528a	5	5	0.208	0.129	
I'	28a	25a	22a	20a							
II	14a	14a	27b	25b							
III	10a	8a	14a	16a							
IV	16a	18a	13a	13a							
V	14a	16a	9a	11a							
Total	100	100	100	100							

**Table 4: Comparison of visible lip print pattern in males and females in Right and Left lower quadrant.**

Sex					Chi-Square Test						
Type	Female		Male			Chi-square		DF		p-value	
	Frequency										
	RLQ	LLQ	RLQ	LLQ	RLQ	LLQ	RLQ	LLQ	RLQ	LLQ	
I	26a	25a	18a	17a	16.165a	11.689a	5	5	0.006	0.039	
I'	32a	29a	17b	16b							
II	18a	16a	23a	26a							
III	2a	5a	12b	10a							
IV	7a	7a	14a	14a							
V	15a	18a	16a	17a							
Total	100	100	100	100							

between lip prints of the right upper quadrant (RUQ) and left upper quadrant (LUQ) in males and females as shown in table no.3.

A statistically significant difference ( $P < 0.05$ ) was observed between lip prints of the right and left lower quadrants in males and females. Type I' and Type II lip prints were gender dependent in RLQ while Type I' was in LLQ. Type I' lip print was the most frequent lip print pattern seen in females in both RLQ and LLQ. whereas Type II was frequently seen in males as shown in table no.4.

### Discussion:

Comparison of the distribution of lip prints in the right upper quadrant (RUQ) of lips in both genders-

In this study of lip prints of the right upper quadrant (RUQ) on 100 males, Type II was seen in maximum numbers (27%) of males while in cases of females (100), Type I' lip print was seen in maximum that is 28% of female population. Similar to the present study different patterns were observed in studies by various researchers. Type III pattern was seen in males and Type II in females. (Ghimire et al.<sup>3</sup> and Gaba Richa et al.<sup>10</sup>). Ghimire et al.<sup>3</sup> found that a Type I pattern was seen in 62% of males and 32% of females in the right upper quadrant. Earlier Augustine et al.<sup>11</sup>

**Table 5: Comparative analysis of lip print pattern in right and left upper & lower quadrants with various studies:**

Studies	Lip print pattern in right upper quadrant		Lip print pattern in left upper quadrant		Lip print pattern in right lower quadrant		Lip print pattern in left lower quadrant	
	Male	Female	Male	Female	Male	Female	Male	Female
Augustine et al (2008) <sup>11</sup>	Type I	Type I	Type I	Type I	Type III	Type III	Type III	Type III
Saraswathi TR et al (2009) <sup>12</sup>	Type III	Type III	-	-	Type III	Type III	-	-
Ghimire et al (2013) <sup>3</sup>	Type III	Type II	-	-	Type III	Type II	Type I	Type I
Gaba Richa et al (2014) <sup>10</sup>	Type III	Type II	-	-	Type III	Type II	-	-
Deepa Jatti et al (2015) <sup>13</sup>	Type II	Type II	-	-	Type II	Type II	----	-
Peeran SW et al (2015) <sup>14</sup>	-	-	Type I 43.24%	Type I 56.71%	-	-	Type I 59.45%	Type I 67.16%
Shalini Ann Mathew et al (2016) <sup>6</sup>	Type I (48%)	Type IV (44%)	Type I	Type IV	Type I (48%)	Type IV (44%)	Type I (32%)	Type I (68%)
Present study	Type II (27%)	Type I' (28%)	Type II (25%)	Type I' (25%)	Type II (23%)	Type I' (32%)	Type II (26%)	Type I' (29%)

found it in 37.75% of males and 35.93% of females whereas in a study by Mathew SA et al.<sup>6</sup> in males, Type I is present in the maximum population i.e., in 48% of total males while females had type IV lip print in 44%. In a study by Mathew SA et al.,<sup>6</sup> in females, the predominant pattern was Type IV in the upper right quadrant, but the males showed a predominant Type I pattern in all four quadrants.

There were no differences in lip print patterns in the right upper quadrant in males and females in studies by some of the authors. Among males, it was found that intersected pattern was most common in the right upper quadrant in males (42%) and females (38%) (Saraswathi TR et al.)<sup>12</sup> whereas the Type II pattern was most common in the right upper quadrant among females and males (Deepa Jatti et al.).<sup>13</sup>

Comparison of the distribution of lip prints in the left upper quadrant (LUQ) of lip in both genders-

In this study of lip prints of the left upper quadrant (LUQ) on 100 males, Type II was seen in maximum numbers (25%) of males while in cases of females (100), type I' lip print was seen in maximum that is 25% of female population. The present study agrees with that of other authors where there were variations in types of lip prints in the left upper quadrant in males and females. In males in the left upper quadrant, Type I was present in the maximum population i.e. in 48% of total males while females had Type IV lip print in 44% of the total female population (Mathew SA et al.).<sup>6</sup>

The lip print pattern in the left upper quadrant was not gender specific in most of the studies where the Type I pattern was seen among 43.24% of males and 56.71% of females (Peeran W et al.

al.<sup>14</sup>). Augustine et al.<sup>11</sup> found it in 10% of males and 8.73% of females. These patterns were more prevalent in the North Indian population thus being region specific.

Comparison of the distribution of lip prints in the right lower quadrant (RLQ) of lips in both genders-

In this study of lip prints of the right lower quadrant (RLQ) on 100 males, Type II was seen in maximum numbers (23%) of males while in cases of females (100), Type I' lip print was seen in maximum that is 32% of female population. Gender variations in results were observed by other authors where in the right lower quadrant, Type I pattern was seen in 54% of males, compared to 45% of females. Ghimire et al.<sup>3</sup> and Mathew SA et al.<sup>6</sup> noted that in males Type I was present in the maximum population i.e., in 32% of total males while females had Type I lip print in 68% of the total female population. However, no variations were seen when Type I pattern was seen among 59.45% of males and 67.16% of females in the lower right quadrant by Peeran W et al.<sup>14</sup>

Comparison of the distribution of lip prints in left lower quadrant (LLQ) of lips in both genders-

In this study of lip prints of the Left lower quadrant (LLQ) on 100 males, Type II was seen in maximum numbers (26%) of males. While in cases of females (100), Type I' lip print was seen in a maximum that is 28% of female population. The results were statistically significant, the studies where there were no differences in lip print pattern in males and females in left lower quadrant being Type I pattern was seen in 57% of males, compared to 51% of females (Ghimire et al.).<sup>3</sup> Similarly, in left lower quadrant, in males Type I was seen in 40% of total males and 46 % of total females (Mathew SA et al.).<sup>6</sup> Type I was predominantly present in the lower middle compartment in males and females (33.8% and 32.5 %, respectively) (Ragab Ali et al.).<sup>15</sup>

The distribution of lip prints in various quadrants by various researchers was discussed; In the present study, lips were divided into four quadrants though some researchers had invariably divided the lips into more than four quadrants/ compartments. Similar to the present study no subject had a single pattern of lip print in any of the studied compartments (Ragab Ali et al.,<sup>15</sup> Venkatesh R et al.).<sup>1</sup> Similarly, Maheswari TNU et al.<sup>16</sup> proved the individuality of lip prints in the Indian population and reported that no one had a single groove type in all areas of the lip. In contrast, Domiaty El et al.<sup>17</sup> found that few numbers of prints (9.63%) had one type of grooves in all areas of the lip, but two or more types of grooves were commonly seen in different areas of the print.

### Conclusion:

A statistically significant relationship was seen between Type I' lip print in the left lower quadrant and Type I' & Type II lip print in the right lower quadrant with the sex of the individual. It can be said that in both the right and left lower quadrants, Type I' lip print was a more frequent pattern seen in females whereas Type II was frequently seen in males. However, a larger population-based study must be done to corroborate the findings. More research is required on diverse groups of people to examine the variations and create in order to effectively utilize the tremendous

importance of lip print patterns serve in forensic investigations.

# References:

1. Venkatesh R, David MP. Cheiloscopy: An aid for Personal Identification. *J Forensic Dent Sci.* 2011;3(2):67–70.
2. Utsuno H, Kanoh T, Tadokoro O, Inoue K. Preliminary study of post mortem identification using lip prints. *Forensic Sci Int.* 2005;149: 29-32.
3. Ghimire N, Nepal P, Upadhyay S, Budhathoki SS, Subba A, Kharel B. Lip print pattern: an identification tool. *Health Renaissance.* 2013;11(3):229-33.
4. Kannan S, Muthu K, Muthusamy S, Sidhu P. Cheiloscopy - A Vital Tool In Crime Investigation. *Int J Forensic Sci Pathol.* 2015; 3(3): 89-93.
5. El Domiaty MA, Al-gaidi SA, Elayat AA, Safwat MD, Galal SA. Morphological patterns of lip prints in Saudi Arabia at Almadinah Almonawarah province. *Forensic Sci Int.* 2010; 179.e1-179.e9.
6. Mathew SA, Kasim K, Mrudula KI, Jayashekeran. Establishing identity using cheiloscopy and palatoscopy. *Sch J Dent Sci.* 2016;3(3):74-80
7. Alvarez M, Miquel M, Castello A, Verdu FA. Persistent lipsticks and their lip prints; new hidden evidence at the crime scene. *Forensic Sci Int.* 2000;112:41-7.
8. Singh P, Oswal M, Karande P. Survey of lip prints among the people of Maharashtra. *Int J Oral Health Med Res.* 2016;2(5):6-8.
9. Tsuchihashi Y. Studies on personal identification by means of lip prints. *Forensic Science.* 1974;3:233–48.
10. Gaba R, Ahmed J, Ongole R, Denny EC, Shenoy N and Binnal A. Scope of cheiloscopy in gender identification. *IJBR.* 2014;5(6):223-26.
11. Augustine J, Barpande S R, Tupkari J V. Cheiloscopy as an adjunct to forensic identification: a study of 600 individuals. *J Forensic Odontostomatol.* 2008;27(2):44-52.
12. Saraswathi TR, Mishra G, Ranganathan K. Study of lip prints. *J Forensic Dent Sci.* 2009;1:28-31.
13. Jatti D, Rastogi P. Digital analysis of lip prints for personal identification: A cross sectional study in South Indian Population. *J Indian Acad Forensic Med.* 2015July-Sept;37(3):289-93.
14. Peeran SW, Kumar N, Abdalla KA, Azaruk FA, Manipady S, Alsaied FM. A study of lip print patterns among adults of Sebha city, Libya; *J Forensic Dent Sci.* 2015 Jan-April;7(1):67-70.
15. Ali R, Refat A & Eldakroory, Sahar & Rahman A, Rania. Characteristic patterns of lip prints in Egyptian population sample at Dakahlia Governorate. *International journal of legal medicine.* 2012;127. 10.1007/s00414-012-0784-5.
16. Maheswari TNU and Gnanasundaram N. Role of Lip prints in Personal Identification and criminalization. *Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicology.* 2011 Jan- June;12(1).
17. Eldomiaty MA, Anwar R I, Algaidi S A. Stability of lip-print patterns: A longitudinal study of Saudi females. *J Forensic and Legal Medicine.* 2014;22:154-8.