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## Analysis of various patterns of Lipri NTS and its variation with gender: A cross - sectional study

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### Abstract

**Introduction:** Cheiloscropy is a forensic science technique that involves the study of lip prints. The uniqueness of the lip prints have made it an additional tool in personal identification. Like fingerprints, DNA profiling and dental records, lip prints can also be used as an added tool in personal identification. The array of furrows and wrinkles in the red part of the lips is called anatomically as figure line arum labiorum rubrorum, which is unique for each individual 4. Lip prints can be classified into various patterns and can help in criminal investigations, particularly for identifying suspects in cases where lip prints are left as evidence at crime scenes.

**Aim:** To evaluate various patterns of lip prints in the population and its variation with gender.

**Materials and Methods:** A random cross-sectional study with a sample size of 95 was conducted in patients who visited the Department of Oral Medicine and Radiology. Recording of lip impressions were performed using dark red lipstick, cellophane strip, magnifying lens, A4 size bond paper. The lip prints recorded were compared with the Suzuki-Tsuchihashi classification.

**Result:** The predominant pattern obtained among the population was the intersecting or type III pattern of lip print. The type III pattern of lip print was more prevalent in the upper lip and lower lip of both genders.

**Conclusion:** In the present research, the lip print patterns observed among our study participants were distinct and did not exhibit any significant similarities. Therefore, the result of our research authenticate that lip prints are unique like fingerprints and thus have forensic importance. Although gender -specific lip patterns show substantial differences, conducting studies with larger samples sizes can enhance the accuracy of distinguishing between males and females.

**Keywords:** Lipri NTS, Cheiloscropy, lip prints, sectional study, significant similarities

### Introduction

Lip print analysis also known as cheiloscropy, is a branch of forensic odontology that involves the examination and classification of lip prints for identification and investigative purposes. Like fingerprints, lip prints are unique to each individual and can be a valuable tool in forensic investigations. These arranged wrinkles and furrows in the red part of the lips are called Sulci labiorum. Cheiloscropy, the study of the grooves and wrinkles on the lips were first described by Fischer in 1902 [5]. Identification of an individual from human remnants is a challenging task for the forensic experts in accidents, mass disasters, suicides, crimes etc. Like fingerprints, DNA profiling and dental records, lip prints can also be used as an additional tool in personal identification due to the uniqueness of the lip print pattern. These lip prints have been seen to recover after trauma, infections and inflammations and remain similar throughout the lifetime of an individual. Lip prints on the crime site will be either visible or latent. Identifying and recording these lip prints are challenging. Dr. Martinez Santos from Brazil pioneered the classification of lip furrows, demonstrating their potential for identification purposes. 7 Locard recommended the usefulness of lip prints in criminal investigation and personal identification in 1932 [5]. The lip patterns are unique to each individual and can be used for various applications as follows:

**Identification and Forensic:** Cheiloscropy plays a crucial role in identifying individuals in criminal investigations.

Lip prints left on crime scenes such as glasses, cups or even on documents can be compared to a suspect lip print. If a match is found, it can serve as strong evidence in court.

**Personal Authentication**

Similar to fingerprint or iris scan, chelioscopy can be used for personal authentication in security systems. For instance, access to restricted areas in secure facilities can be granted based on lip print scan.

**Psychology and Behaviour Analysis**

Some studies suggest a potential link between lip patterns and personality traits. While this field is still in its infancy, cheiloscopy could be used to explore the relationship between lip print and human behaviour.

**Anthropology and Archaeology**

Lip prints can be used in anthropological studies to understand the genetic diversity of different populations.

In the present study, we have recorded and evaluated various lip print patterns among the patients who had reported to the department and analysed the upper and lower lip-wise and gender-wise predilection of the lip print pattern.

**Materials and Methods**

**Study Design**

A random cross-sectional study was conducted among the patients who reported to the Department of Oral Medicine and Radiology. The study lasted for two months. The sample size was 95, of which 42 were males and 53 were females. The age range considered was 15-40 years. Recording of lip impression was performed with dark red lipstick, cellophane strip, A4 bond paper and magnifying lens. The recorded lip prints were compared with Suzuki and Tsuchihashi Classification.

**Suzuki and Tsuchihashi Classification**

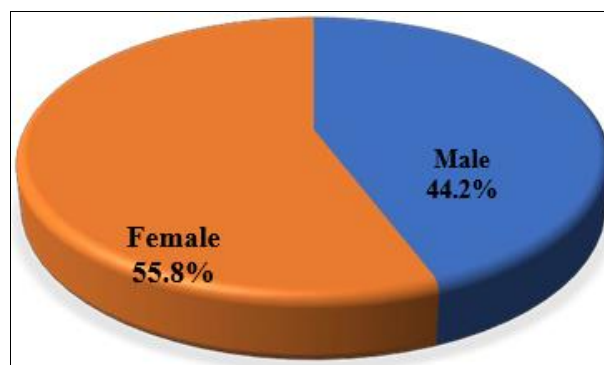
- **Type I:** Clear-cut grooves running vertically across the lip
- **Type IA:** Straight grooves; that disappear halfway instead of covering the entire breadth of the lip
- **Type II:** Fork grooves in their course
- **Type III:** Intersecting grooves
- **Type IV:** Reticulate grooves
- **Type V:** Undermined

The lips were cleaned well and a thin layer of dark red colored lipstick was applied to the lips and the subjects were asked to rub both the lips to spread the lipstick evenly. Impressions were recorded on the glued side of the cellophane strip. The tape was removed with a single swing and stuck to the A4 bond paper. The lip prints were observed using a magnifying lens and the data were recorded. Lip prints were classified by using the Suzuki and Tsuchihashi classification. To study the lip prints, each individual's lips were divided into two compartments - upper lip and lower lip. Each compartment was analysed and the overall groove patterns was recorded.

**Sampling criteria**

A random sampling technique was done. The formula for sample size calculation was size  $n = ( \frac{z^2 (1 - p)}{e^2} )$ . The study included patients who did not have any congenital anomalies or lesions on their lips. The exclusion criteria were subjects with lesions or anomalies of the lips and

subjects with any known allergy to lipsticks.



**Fig 1:** Gender

**Statistical method**

Data analysis was conducted using SPSS version 22.0. The quantitative variables were expressed as mean and standard deviation and qualitative variables were expressed as proportions. The relationship between qualitative variables were assessed by chi-square test. A p-value < 0.05 was considered statistically significant.

**Results**

The data obtained from the present work revealed that no two lip prints were exactly the same of the taken sample of 95, (44.2%) were males and (55.8%) were females. Table 1 and 2 shows the frequency and percentage of occurrence of various lip prints. In the upper lip, the most predominant lip pattern obtained was the Type III pattern with intersecting grooves (81%) followed by Type IV (9.5%), Type II (7.4%) and Type I' (2.1%). The most common pattern obtained in lower lip was type III pattern (81%) followed by Type II (10.5%), Type IV (7.4%) and Type V (1.1%).

**Table 1:** Shows frequency and percentage of occurrence of various lip print patterns in upper lip

Upper Lip Print Pattern	Frequency	Percent
Type I'	2	2.1
Type II	7	7.4
Type III	77	81.1
Type IV	9	9.5
Type V	0	0
Total	95	100

**Table 2:** Shows frequency and percentage of occurrence of various lip print pattern in lower lip

Lower Lip Print Pattern	Frequency	Percent
Type I'		
Type II	10	10.5
Type III	77	81.1
Type IV	7	7.4
Type V	1	1.1
Total	95	100

Table 3. Shows the frequency of occurrence of upper lip patterns in the male subjects. The most frequent pattern in males was Type III and the least found was Type IV followed by Type I'. In females, the predominant pattern was Type III and females showed a significantly higher occurrence of Type IV pattern than males. A p-value of < 0.001 shows a significant difference between the upper lip print pattern and the gender distribution

**Table 3:** Shows the frequency and percentage of various lip print patterns in upper lip among males and females

Upper Lip Print Pattern	Male		Female		Total	
	N	%	N	%	N	%
Type I	2	4.8	0	0	2	2.1
Type II	7	16.7	0	0	7	7.4
Type III	33	78.6	44	83	77	81.1
Type IV	0	0	9	17	9	9.5
Total	42	100	53	100	95	100

	$\chi^2$	DF	P
Chi-Square test	18.546	3	< 0.001

Table 4. shows the frequency and percentage of occurrence of various lip pattern in lower lip among the gender. Both the genders showed a predominant type III pattern in lower lip. Females showed a higher value of Type II and Type IV pattern than males. A p-value of 0.624 shows no significant difference between the lower lip pattern and the gender distribution.

**Table 4:** Shows the frequency and percentage of various lip print patterns in lower lip print pattern

Lower Lip Print Pattern	Male		Female		Total	
	N	%	N	%	N	%
Type II	4	9.5	6	11.3	10	10.5
Type III	36	85.7	41	77.4	77	81.1
Type IV	2	4.8	5	9.4	7	7.4
Type V	0	0	1	1.9	1	1.1
Total	42	100	53	100	95	100

	$\chi^2$	DF	P
Chi-Square test	1.760	3	0.624

The inter-observer bias among the observer 1 and observer 2 was eliminated by the Kappa coefficient (k). The measure of agreement (k) for upper lip print was 0.43, indicating the value as moderate agreement with the inter-observer and the measure of agreement (k) for lower lip print was 0.29, indicating the value as fair agreement with the inter-observer.

## Discussion

Cheiloscopy is a forensic science technique that involves the study and analysis of lip patterns, particularly the lines, wrinkles and grooves on the vermilion border of the lips. Forensic odontologists use specialised techniques to study and compare lip prints found in crime scenes with those of potential suspects. There are several methods for retrieving lip prints, which can be useful in forensic analysis and identification. Methods like the lipstick method, fine powder method, chemical method, High-resolution photography method, 3D digital scanners and infrared imaging techniques are implemented. This can be particularly useful in cases where other forms of evidence may be lacking or inconclusive. The selection of a method depends on specific circumstances and the desired quality of lip print analysis, as each approach comes with its distinct advantages and limitations. In our study, the lipstick method was advocated, and each individual's lips were analysed by dividing lips into two compartments upper lip and lower lip. Each compartment was analysed and the overall groove patterns were recorded. The lip prints collected were categorised using the classification system proposed by Suzuki and Tsuchihashi. The uniqueness of the lip print was confirmed yet again by our study. It was observed that in the entire study population, the Type III lip pattern was the most prevalent among males

and females. These findings were similar to the one obtained in the study conducted by Prasad *et al.* on the Aryan-Dravidian and Mongloid group which obtained a Type III pattern as the most prevalent lip pattern among both genders. Studies conducted by Govindkar, Saraswathi, *et al.* and Sivapathasundaram also produced similar results.

In contrast to our study, the study conducted in 755 individuals in different ethno-racial groups of India, (namely Caucasoids, Australoids, Mongoloids and Negritos), showed Type I lip print pattern as the most prevalent pattern in both males and females. A similar pattern was observed by Vahanwala *et al.* (in 600 individuals), Archana *et al.*, Randhawa *et al.* and Sandhu *et al.*

## Conclusion

In the present research, the lip print patterns observed among our study participants were distinct and did not exhibit any significant similarities. Therefore, the result of our research authenticate that lip prints are unique like fingerprints and thus have forensic importance. Although gender -specific lip patterns show substantial differences, conducting studies with larger samples sizes can enhance the accuracy of distinguishing between males and females.

## Limitation

Blurring or spoiling of lip prints, due to prominent facial hair among males were encountered during the study. Patients at the very young and elderly ends of the age spectrum were not included in the study as the younger age exhibited immaturity of lips and the older participants were excluded due to the diminished anatomical details and tonicity in the advanced age, as it could potentially impact the accuracy of the obtained lip patterns. As it was a manual study (without automated methods) there were variations in the inter-observers results.

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**Conflict of interest:** There are no conflicts of interest.

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