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Analysis of Lip Prints as an Indispensable Tool for Identification and Sexual Dimorphism- A Cross Sectional Study

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ABSTRACT

Introduction: Cheiloscopy is one of the investigative methods that utilises the anatomy and morphology of lips to identify individuals by their lip prints. Lip prints are a distinctive pattern made up of ridges and grooves on the labial mucosa, or sulci labiorum; cheiloscopy is the study of such patterns.

Material and Methods: The study group comprised of 50 males and 50 females aged between 18 and 25 years in the Department of Forensic Medicine and Toxicology, Jawaharlal Nehru Medical College, AMU, Aligarh for a period of 1 year i.e., from August 2021 to September 2022.

Results: Each individual lips were divided into 4 regions- upper right, upper left, lower right, and lower left and a total of 400 lip regions (100x4) were assessed for 6 types of lip groove patterns- Type I, Type I', Type II, Type III, Type IV, and Type V as per the Suzuki and Tsuchihashi classification.The most common type of lip print pattern in males was Type III (32.5%) while in females it was Type II (36%).

Conclusion: Lip prints are distinctive to each person and can be used to identify a person and ascertain their gender.

Keywords: Cheiloscopy, Lip print, Identification

INTRODUCTION

Identification is the determination of the individuality of a person whether living or dead.[1] Just like Dactylography and DNA fingerprinting which have been successful in personal identification, cheiloscopy or lip print scan be instrumental in identifying a person positively and can be used to validate the presence or absence of a person at the scene of crime. The lips perform numerous functions such as eating, drinking, speaking, and emotional expressions, while sensory function for sensuality and sexuality is achieved by a complex system of muscles and supporting structures.[2]

Fischer initially reported grooves on both the upper and lower lips in 1902, and Locard later suggested the cheiloscopic technique in 1932 for identifying individuals as well as analysing crime scenes.[3-5] In his book "Homicide Investigation," published in 1950, Synder additionally addressed the relevance of the lip grooves' uniqueness as a distinctive character, similar to the ridge patterns found on fingerprints. Dr. Martin Santos developed a straightforward system for categorising lip

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prints in 1960 and suggested that these lip characteristics may be utilized in personal identification.[6] The first study in Europe on lip prints was conducted in Hungary in 1961 after these prints were discovered on a glass door at the crime scene. And at this point, it was established that lip traces might be used for criminalistics identification.7The practical use of extracting lip prints in forensic science was first described by Suzuki in 1967. Later, in 1970, Suzuki and Tsuchihashi gave the grooved lip prints the term Figura linearum labiorum rubrorum. Additionally, McDonell examined the lip prints of identical twins in 1972 and discovered that while they were similar in every way, their lip patterns were different. Cheiloscopy was listed by Cottone in his book "Outline of Forensic Dentistry," published in 1981, as one of the particular techniques for individualization.

Similar to fingerprints, palm prints, and footprints, the pattern of wrinkles on the lips has particular characteristics. Lip prints are distinctive and consistent throughout the course of a lifetime.These patterns are distinguishable as early as the sixth week of intrauterine life.[8]The furrows or grooves on the labial mucosa or sulci labiorum form a characteristic pattern called lip prints, the study of which is referred to as Cheiloscopy. It can also be defined as a method of identification of a person based on distinctive arrangements of lines present in the zone of transition of human lip, between the inner labial mucosa and outer skin or as a discipline dealing with lines appearing on red part of the lips.

At crime scenes, lip prints may be found on a wide range of items, such as drinking glasses, cigarette butts, tissues, or napkins. Both direct inspection and photography permit more accurate and comprehensive interpretations needed for lip print investigations. To identify suspects and further corroborate their presence at the crime scene, it is crucial to properly investigate the distinctive characteristics of lip prints.The oily and moist secretions from sebaceous and salivary glands situated at the vermillion border which is the sharp demarcation between the lip and the adjacent normal skin, and subsequent moisturization from the tongue facilitates the formation of a latent lip print whenever there is contact with lips leaving behind an important form of transfer evidence.

In postmortem analysis, lip groove patterns have to be acquired within 24 hours of death to avoid any possible postmortem degradation of lip mucosa.[9]The objective of this study is to assess the distribution of lip print pattern among males and females and to evaluate the lip print patterns for their uniqueness.

MATERIAL AND METHODS

The present study was conducted in the Department of Forensic Medicine and Toxicology, Jawaharlal Nehru Medical College, AMU, Aligarh for a period of 1 year i.e., from August 2021 to September 2022. The study sample comprised of 100 medical students of North India i.e. 50 males and 50 females aged between 18 and 25 years for assessing the pattern of lip prints. People with congenital lip abnormalities, chapped lips, sores on the lips, people who are allergic to lipstick, and who have had surgery on their lips in the past were not included in the study. The participants were given a detailed explanation of the study's protocol and objectives before their informed consent was sought.

Cellophane tape, white paper, a magnifying glass, and a dark red lipstick were the materials utilised to record the lip groove patterns. Before beginning the procedure, the individual lips were wiped with a damp tissue. With a single, delicate stroke, the lipstick was equally distributed on the vermilion border of both lips. The test subjects were instructed to rub both lips together to spread the lipstick. Individuals were then asked to relax without stretching their lips.

Cellophane tape was used to lift the lip groove patterns on the upper lip from one side

to the other, and then the tape was adhered to white bond paper as a permanent record. For the lower lips, the same procedure was done. The remaining lipstick was removed from the lips with a tissue before being thoroughly washed after applying the lip groove designs to the bond paper. By predominantly descending a perpendicular i.e. vertical line from the philtrum of the lips and horizontal line between the upper lip and lower lip, the lip groove patterns were divided into four regions: upper right region, upper left region, lower right region, and lower left region. Under a magnifying glass, the obtained lip groove patterns were thoroughly studied. The quantity, length, branching, and combinations of the lines and furrows were recorded.

RESULTS

A total of 100 individuals were included in the study, comprising of 50 males and females each, in the age group of 18 to 25 years. Each individual lips were divided into 4 regions- upper right, upper left, lower right, and lower left and a total of 400 lip regions (100x4) were assessed for 6 types of lip groove patterns- Type I, Type I', Type II,Type III, Type IV, and Type V as per the Suzuki and Tsuchihashi classification. In the present study, no one had a single type of lip print in each of the four compartments, and no two or more people shared a lip print pattern of the same kind. Different patterns could be seen in each lip print. The lip print appeared to be a combination of different types of grooves rather than just one type.

When the overall pattern was assessed among all the lip quadrants of the study subjects, it was found that branched (27.2%) and intersecting (25.2%) pattern was most common, both among males and females. However, the least common was the reticular pattern seen in 11% individuals as depicted in table number 1. Among males, it was found that intersected pattern was most common in all compartments i.e. 32.5%, while the least common pattern was the vertical pattern i.e. Type I and Type I' having 7.5 and 6% respectively as seen in table number 2. According to table number 3, on evaluation of the lip prints of the females,it was found that branched pattern was most common in all compartments i.e. 36%,while the least common pattern was the reticular and undetermined i.e. 5.5% and 5 % respectively.

In the present study, in right upper region of the lips, the most common type of pattern in male was Type III(30.5%) and in females the most common type of pattern was Type II (37.5%). In left upper region, the most common type of pattern in male was TypeIII (34%) and in females the commonest pattern was Type II (35.5%). In left lower region, the most common type of pattern in male was Type III(33%) and in female the most common type wasType II (34.5%). In right lower region,

Table 1: Distribution of Lip groove patterns

Lip groove pattern	Number (100x4)	Percentage
Type I	46	11.5
Type I	51	12.8
Type II	109	27.2
Type III	102	25.5
Type IV	44	11
Type V	48	12
Total	**400**	**100**

Table 2- Distribution of Lip groove patterns among males

Lip groove pattern	Number (50x4)	Percentage
Type I	15	7.5
Type I'	12	6
Type II	37	18.5
Type III	65	32.5
Type IV	33	16.5
Type V	38	19
Total	**200**	**100**

Table 3- Distribution of Lip groove patterns among females

Lip groove pattern	Number (50x4)	Percentage
Type I	31	15.5
Type I'	39	19.5
Type II	72	36
Type III	37	18.5
Type IV	11	5.5
Type V	10	5
Total	**200**	**100**

Table 4- Distribution of lip groove pattern according to lip quadrant

Lip quadrant	Gender	Most common type of pattern	Percentage
Right Upper	Male	Type III	30.5
	Female	Type II	37.5
Left Upper	Male	Type III	34
	Female	Type II	35.5
Left Lower	Male	Type III	33
	Female	Type II	34.5
Right Lower	Male	Type III	31.5
	Female	Type II	36.5

the most common type of pattern in male and female was Type III(31.5%) and Type II (36.5%) as depicted in table number 4.

DISCUSSION

Lip prints are considered one of the most essential types of transfer evidence, making them particularly helpful in forensic investigation as well as personal identification. In Poland in 1966, the first cheiloscopic breakthrough was made when a burglary incident window pane revealed a lip print. After conducting the examination, the expert came to the conclusion that the trace of lips found at the site did not belong to the suspect.[10]

Suzuki and Tsuchihashi[11,12] created a new classification of lip prints by referring to the grooves on the labiorum rubrorum as "sulci labiorum rubrorum" and the lip prints made up of these grooves as "Figura linearum labiorum rubrorum," or simply "lip print." According to the shape and direction of the grooves, lip prints were divided into six categories. The patterns on the lips are most frequently categorized using this system. Suzuki and Tsuchihashi's classification of lip prints is as follows-

1. Type I- A clear-cut line or groove running vertically across the lip
2. Type I'- Straight grooves that disappear half way into the lip instead of covering the entire breadth of the lip or partial-length groove of Type I
3. Type II- A branched groove
4. Type III- An intersected groove
5. Type IV- A reticular groove
6. Type V- Grooves that do not fall into any of the above categories and cannot be differentiated morphologically

Various studies have shown conflicting results about the lip print pattern in males and females. In the current study, the most typical lip print pattern in both males and females was determined using the quadrant approach. This technique split the lip prints into four distinct quadrants, and each quadrant was examined independently for males and females. After the analysis, it was discovered that no two peopleor morehave lips that are alike, proving that a person's lip print is a significant and distinctive characteristic.

The most common lip print pattern among males in our study was type III which was in accordance with studies conducted by Saraswati et al[13], Gupta et al[14] and Bajpai et al.[15]and contradictory to studies conducted by Sharma et al[16] and Babu et al.[17]On evaluation of the lip prints of the females, it was found that branched pattern i.e. Type II was most

common in all lip quadrants which is similar to studies conducted by Patel et al[18] and Bidal et al[19] while contradictory to studies conducted by Verghese et al[20] and Ashwini rani et al.[21]

The studies on Indian population have produced conflicting findings, Vahanwala and Parekh[22]reported in their study in Mumbai that Type I was the most prevalent while Sivapathasundharamet al[23] concluded that in Indo-Dravidian population Type III was most common type of lip pattern. According to Maheswari and Gnanasundaram[24] Type II lip groove pattern is more frequent among Indian population.

CONCLUSION

Every person has a different lip groove pattern, and depending on a person's gender, certain patterns are more common than others. Cheiloscopy is a simple and reasonably priced technique that has to be applied thoroughly to larger samples and in various global populations.To be an effective tool, a database on various lip prints in various populations must be assembled.When no other traditional methods of identification are available, lip prints are just as reliable as finger prints for criminal identification.The usage of this method in routine civil and criminal litigation needs to increase, though, as far as the Indian judicial system is concerned. Cheiloscopy can be used as an effective tool in the identification of the persons from pieces of evidence that may be left behind from lip prints.

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