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Cheiloscopy as a Tool for Identification

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ABSTRACT

Establishing the identity of the living or the deceased, which is an essence of any crime investigation, is one of the most challenging matters that forensic science has to deal with. Cheiloscopy is one of the newly emerging tools that aid in this. It is the study of the grooves present on the human lips, at the zone of transition of outer skin and inner labial mucosa. The present study was conducted in the Department of Anatomy, Gauhati Medical College, Guwahati, Assam, amongst a group of 145 1st MBBS students comprising of 89 males and 56 females, with an aim to determine the predominant lip print pattern in different lip quadrants and also to find out any similarity in distribution of lip print patterns in different quadrants in males and females. The prints were analysed after dividing the lips into four quadrants: right upper as Quadrant I, left upper as Quadrant II, left lower as Quadrant III, and right lower as Quadrant IV. The patterns were analyzed following the classification of Suzuki and Tsuchihashi. The recorded data were then statistically analysed using Student's T-test. P value ≤ 0.05 is considered as statistically significant. The data obtained in this study hopes to contribute to the knowledge and understanding of the uniqueness and distribution of lip prints and in turn help in certain medico-legal practices.

***Keywords**: Cheiloscopy, Lip print, Identification*

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INTRODUCTION

'Identity' is a set of physical characteristics, functional or psychic, normal or pathological, that defines an individual.[1] Establishing the identity of the living or the deceased is an essence of any crime investigation. This is one of the most challenging matters that forensic science has to deal with considering the fact that every individual has distinctive traits.[2] Cheiloscopy is one of the newly emerging tools that aid forensic experts in establishing the identity of an individual.[3] The groves or furrows present on the human lips, which are also known as *Sulci Labiorum* are unique to each person.[4] Cheiloscopy is the study of these grooves present at the zone of transition of outer skin and inner labial mucosa (Etymology: from the Greek word *'Cheilos'* which means lips and *'scopy'* which means to study or to examine).[5-8] It is possible to identify lip print patterns as early as the sixth week of intra-uterine life. Thereafter, these patterns rarely change. Literature suggests that even following trauma, the lips retain the groove pattern after healing.[9]

R. Fischer was the first anthropologist to describe the furrows on human lips in 1902.[6,10-12] However, the use of lip prints for personal identification was first recommended by French criminologist, Edmond Locard in 1932.[1,3,5] In 1960, Dr. Martin Santos devised a simple system for classifying lip prints.[9,13-15] In 1967, Suzuki made a detail investigation of the measurement of lips, the use and the colour of rouge and method of its extraction to obtain useful data for forensic application. Later in 1971, Yasuo Tsuchihashi and Kazuo Suzuki conducted a study and they devised their own classification, which is the most widely accepted classification system of lip prints.[10-14]

Aims: (i) To determine the predominant lip print pattern in different lip quadrants in males and females and (ii) To

find out any similarity in distribution of lip print patterns in different quadrants in males and females.

MATERIAL AND METHODS

Materials:

1. A dark coloured frosted lipstick (Elle18: Jamm)
2. Cellophane tape - 2 inches wide.
3. White bond paper (Royal Executive Bond, Premium White A4 sheets)
4. Magnifying glass (10X)
5. Pen for labelling individual details.

Method:

The present study has been conducted in the Department of Anatomy, Gauhati Medical College, Guwahati, Assam, amongst a group of 145 1st MBBS students comprising of 89 males and 56 females between the age group of 18 to 23 years, having different ethnic backgrounds, after approval of the Institutional Ethical Committee. All the participants were briefed about the purpose of the study and written informed consent was also taken from them. Care was taken to select individuals having no lesions, whether active or passive on the lips. Also, individuals with known hypersensitivity to lipsticks, or other physical disability were not included in the study.

Collection of Prints:

The subject was asked to open the mouth and lipstick was applied on the vermillion border with a single stroke. Following two minutes of waiting, the glued portion of the cellophane tape was applied to the lips by applying gentle pressure for a few seconds. Then the tape was carefully lifted from the lips, from one end to the other, avoiding any smudging of the print. This strip of cellophane was then stuck on to a white A4 sheet. This served as a permanent record of the lip print.

Analysis of Prints:

The recorded prints were studied with a magnifying lens. These were analyzed after dividing the lips into four quadrants: right upper as Quadrant I, left upper as Quadrant II, left lower as Quadrant III, and right lower as Quadrant IV. The patterns were analyzed following the classification of Suzuki and Tsuchihashi (**Table 1, Figure 1**).[10]

Table 1 Classification of lip prints according to Suzuki and Tsuchihashi[10]

TYPE	DESCRIPTION
Type I	Clear-cut vertical grooves that run across the entire lip
Type I'	The grooves are straight but disappear half way instead of covering the entire breadth of the lip
Type II	The grooves fork/branch in their course (Y-pattern)
Type III	The grooves intersect
Type IV	The grooves are reticular
Type V	Undetermined, i.e. the grooves do not fall into any of the Types I – IV

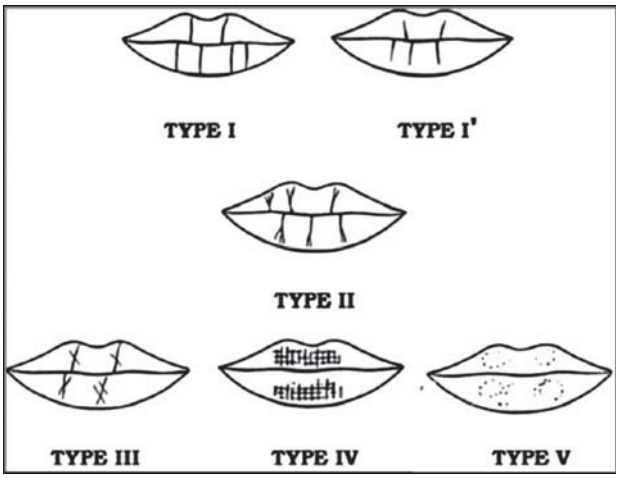

Figure 1 Classification of lip prints as proposed by Suzuki and Tsuchihashi[10] (1970)

The recorded data were then statistically analysed using Student's T-test. P value ≤ 0.05 was considered as statistically significant.

OBSERVATION AND RESULTS

In the present study it was seen that in males, in Quadrant I i.e. right upper quadrant, Type I (complete vertical) was the most predominant pattern with a relative frequency (fr) of 0.407 and Type I' (incomplete vertical) was the least common pattern with a relative frequency (fr) of 0.117. In Quadrant II i.e. left upper quadrant, Type I' was the most common pattern (fr= 0.648) and Type III the least common pattern (fr=0.082). Quadrant III, i.e. left lower quadrant showed Type III as the most common pattern with fr = 0.324 and Type V the least common pattern (fr=0). In Quadrant IV i.e. right lower quadrant, Type III (fr=0.432) and Type IV (fr=0.086) were the most and least common pattern respectively. [**Table 2, 3** & **Figure** 2(a), 2(b) & 2(c).]

Table 2 Male cases with different lip print patterns in different quadrants

Quadr-ants	Type I (Complete Vertical)	Type I' (Incomplete Vertical)	Type II (Branched)	Type III (Intersecting)	Type IV (Reticular)	Type V (Undetermined)
I	24	2	45	6	11	1
II	9	11	53	3	13	1
III	9	2	57	12	8	0
IV	17	2	52	16	3	1
Sum	59	17	207	37	35	3
Mean	14.75	4.25	51.75	9.25	8.75	0.75
SD	±7.228	±4.500	±4.992	±5.852	±4.349	±0.500
SEM	±3.614	±2.250	±2.496	±2.926	±2.174	±0.250

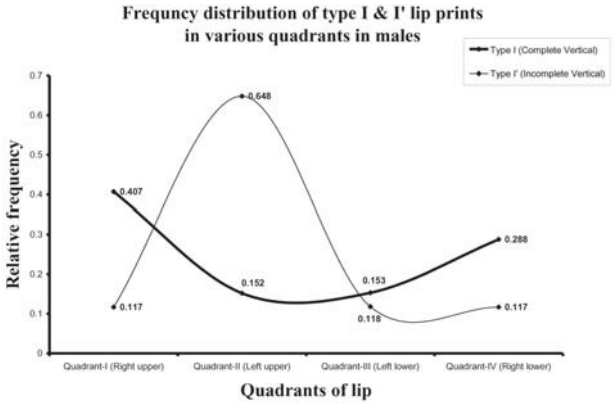

Figure 2(a) Relative frequency distribution

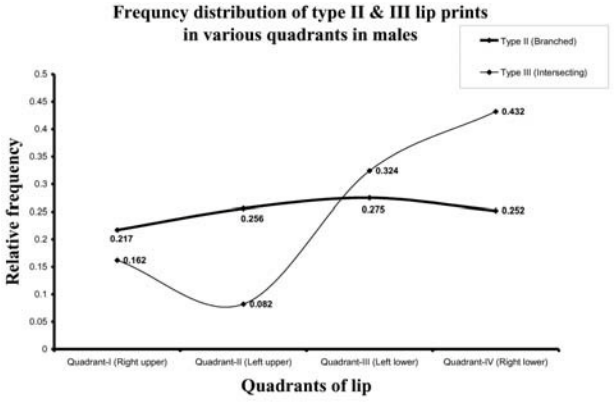

Figure 2(b) Relative frequency distribution

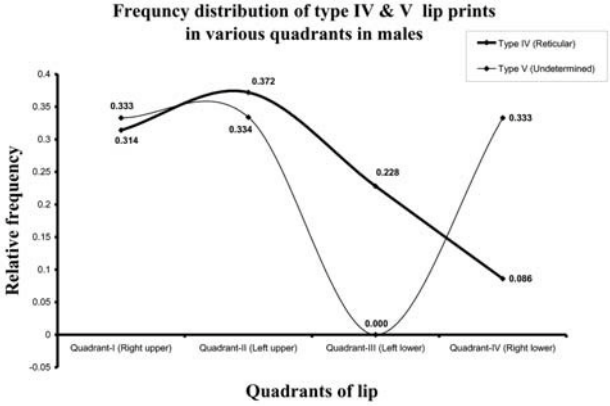

Figure 2(c) Relative frequency distribution

Table 3 Relative frequency of different types of lip prints in various quadrants in males

Class interval of different quadrants	Type I (Complete Vertical)	Type I2 (Incomplete Vertical)	Type II (Branched)	Type III (Intersecting)	Type IV (Reticular)	Type V (Undetermined)
Quadrant I (Right upper)	0.407	0.117	0.217	0.162	0.314	0.333
Quadrant II (Left upper)	0.152	0.648	0.256	0.082	0.372	0.334
Quadrant III (Left Lower)	0.153	0.118	0.275	0.324	0.228	0.000
Quadrant IV (Right lower)	0.288	0.117	0.252	0.432	0.086	0.333
SUM	1.000	1.000	1.000	1.000	1.000	1.000

In **Table 3** we have seen that in Type I, Type II, Type III, Type IV and Type V, the highest relative frequency can be seen respectively as, 0.407 (Quadrant I), 0.648 (Quadrant II), 0.275 (Quadrant III), 0.432 (Quadrant IV), 0.372 (Quadrant II) and 0.0.334 (Quadrant II), which is evident in **Figure 2(a), 2(b) & 2(c).**

In case of females, it was observed that in Quadrant I, Type I (incomplete vertical) was the most predominant pattern with a relative frequency (fr) of 0.384 and Type V (undetermined) was the least common pattern with a relative frequency (fr) of 0.000. In Quadrant II, Type V was the most common pattern (fr=1.000) and Type I (fr=0.096) the least common pattern. Quadrant III, showed Type I as the most common pattern (fr=0.290) and Type V (fr=0) the least common pattern. In Quadrant IV, Type

III (fr=0.384) and Type V (fr=0) are the most and least common patterns respectively [**Table 4, 5** & **Figure 3(a), 3(b)** & **3(c)]**.

Table 4 Female cases with different lip print patterns in different quadrants

Quadr-ants	Type I (Complete Vertical)	Type I' (Incomplete Vertical)	Type II (Branched)	Type III (Intersecting)	Type IV (Reticular)	Type V (Undetermined)
I 9	5	30	5	7	0	
II 3	6	30	4	10	2	
III 9	0	37	7	4	0	
IV 10	2	31	10	1	0	
Sum	31	13	128	26	22	2
Mean	7.75	3.25	32	6.5	5.5	0.5
SD	±3.202	±2.754	±3.367	±2.646	±3.873	±1.000
SEM	±1.601	±1.377	±1.683	±1.323	±1.936	±0.500

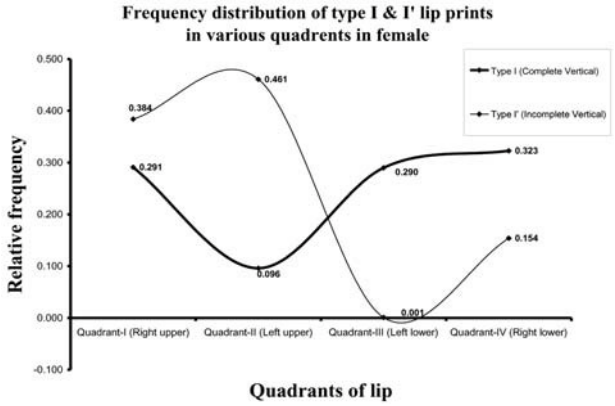

Figure 3(a) Relative frequency distribution

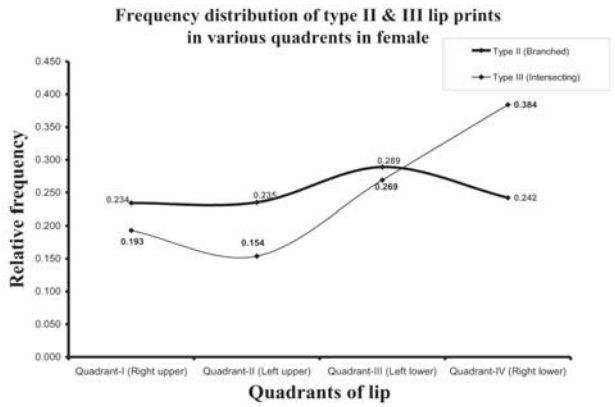

Figure 3(b) Relative frequency distribution

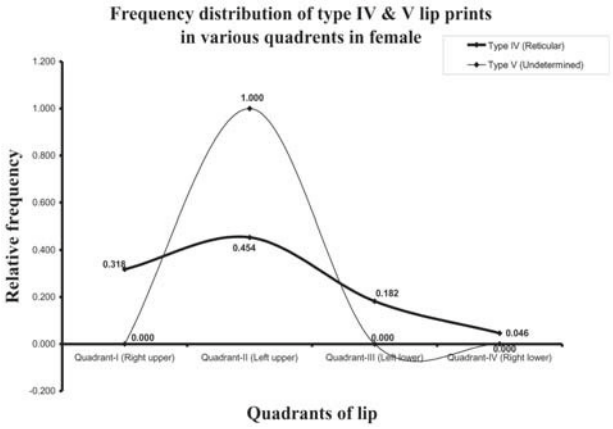

Figure 3(c) Relative frequency distribution

Table 5 'Relative frequency' of different types of lip prints in various quadrants in females

Class interval of different quadrants	Type I (Complete Vertical)	Type I2 (Incomplete Vertical)	Type II (Branched)	Type III (Intersecting)	Type IV (Reticular)	Type V (Undetermined)
Quadrant I (Right upper)	0.291	0.384	0.234	0.193	0.318	0.000
Quadrant II (Left upper)	0.096	0.461	0.235	0.154	0.454	1.000
Quadrant III (Left Lower)	0.290	0.001	0.289	0.269	0.182	0.000
Quadrant IV (Right lower)	0.323	0.154	0.242	0.384	0.046	0.000
SUM	1.000	1.000	1.000	1.000	1.000	1.000

In **Table 5** we have seen that in Type I, Type II, Type III, Type IV and Type V, the highest relative frequency can be seen respectively as, 0.323 (Quadrant IV), 0.461 (Quadrant II), 0.289 (Quadrant III), 0.384 (Quadrant IV), 0.454 (Quadrant II) and 1.000 (Quadrant II) which is evident in **Figure 3(a), 3(b)** & **3(c)**.

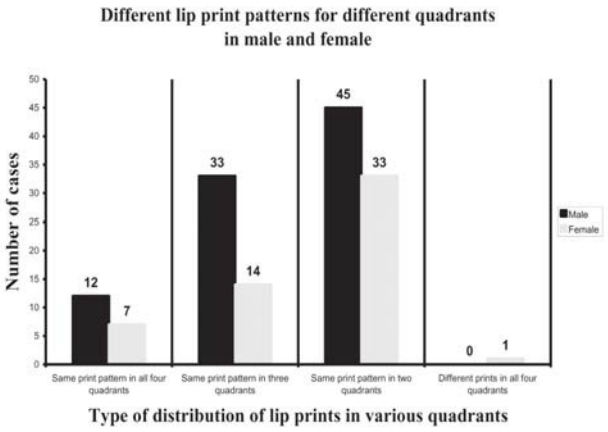

Figure 4 Comparison of lip print patterns in different quadrants in males and females

Table 7 Level of significance of differences

Sl. No.	Comparison of mean between	"t"	P
1	Number of male cases in Type II (Branched) and Type 1 (Complete vertical)	8.424	<0.001
2	Number of male cases in Type 1 (Complete vertical) and Type III (Intersecting)	1.183	>0.05
3	Number of male cases in Type III (Intersecting) and Type IV (Reticular)	0.137	>0.05
4	Number of male cases in Type IV (Reticular) and Type I2 (Incomplete vertical)	1.438	>0.05
5	Number of male cases inType I2 (Incomplete vertical) and Type V (Undetermined)	1.546	>0.05
6	Number of female cases inType II (Branched) and Type 1 (Complete vertical)	10.443	<0.001
7	Number of female cases inType 1 (Complete vertical) and Type III (Intersecting)	0.602	>0.05
8	Number of female cases in Type III (Intersecting) and Type IV (Reticular)	0.426	>0.05
9	Number of female cases in Type IV (Reticular) and Type I2 (Incomplete vertical)	0.947	>0.05
10	Number of female cases in Type I2 (Incomplete vertical) and Type V (Undetermined)	1.878	>0.05

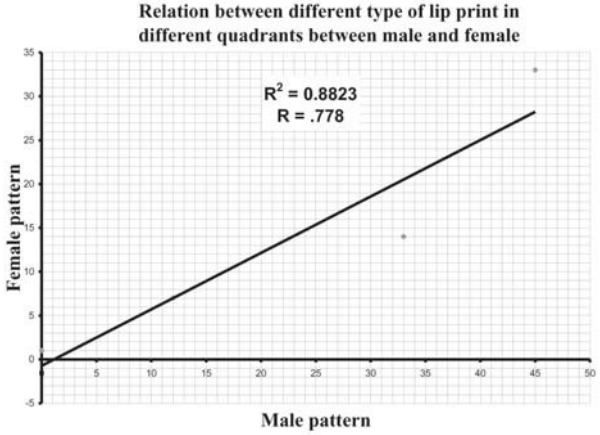

Figure 5 XY (Scatter) chart showing trend line & R value

There are various types of distribution of lip print patterns in the different lip quadrants as shown in **Figure 4**, but highest numbers of cases in both male and female category are seen as, "same print pattern in two quadrants" and lowest as "different print in all four quadrants". However there is always a strong relation between these patterns in various quadrants in male and female (R= 0.778) as shown in **Figure 5**.

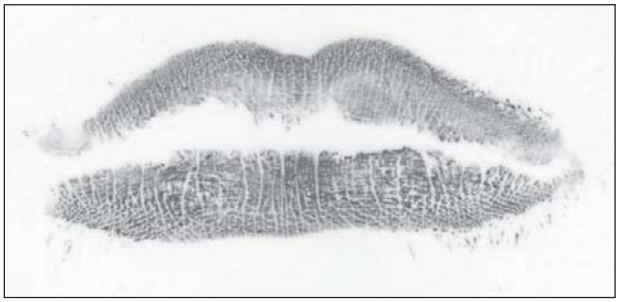

Figure 8 Lip print of a female showing type II, I, IV & IV in quadrants I, II, III & IV respectively.

DISCUSSION

Traditional methods of identification include anthropometry, fingerprinting, sex determination, age estimation, height measurement, blood group differentiation, DNA fingerprinting, odontology, etc.[8] Study of lip prints, i.e. cheiloscopy is emerging as an important tool to aid in personal identification since its inception in 1902. Cheiloscopic techniques have an equal value in relation to other methods of forensic evidence for personal identification.[17] In a crime scene investigation, lip prints can link a subject to a specific location if found on clothes, or other objects such as glasses, cups or even cigarette butts.[18]

A number of studies have been conducted by various research workers in this field. Of these, Dr. Santos, Suzuki K. and Tsuchihashi Y deserve special mention, for their attempts in classifying lip prints, which are still followed worldwide.

In our present study, the distribution of lip prints in all the 145 subjects was distinct and unique. None of the patterns were identical in any two subjects. This finding is consistent with the findings of Suzuki K. and Tsuchihashi Y[10,14], Venkatesh R et al[19], Multani S et al[20] and various other authors.[1]

Further, lip prints did not comprise of a single type alone, but appear to be a combination of different patterns in all four quadrants. This is also consistent with the observations made by Tsuchihashi[10] and Venkatesh R.[19] When the similarity of print patterns in the different quadrants is considered, the present study is seen to co-relate with the findings of Venkatesh R.[19]

CONCLUSION

From the present study it can be concluded that in males, when the quadrant-wise distribution of lip prints is considered, Type I was the most predominant pattern in Quadrant I. The most predominant patterns in Quadrant II, Quadrant III, and Quadrant IV were found to be Type I', Type III and Type III respectively.

Further, on considering all the four lip quadrants together, the number of cases with Type II (branched) pattern is much higher than the other varieties with very high significance ($p < 0.001$). Apart from Type II (branched) pattern, the number of cases in ascending to descending are, respectively, Type I, Type III, Type IV, Type I' and Type V, but all of these are without any significance ($p > 0.050$).

In females, it was observed that in Quadrant I, Type I was the most predominant pattern. In Quadrant II, Type V, Quadrant III Type I and Quadrant IV, Type III was the most common pattern.

The present study further concludes that when the quadrant-wise distribution of prints is considered in both sexes, all the four quadrants show different prints in 0.68% of the females. None of the male subjects showed different prints in all four quadrants. Similar print patterns were seen in all four quadrants in 8.3% males and 4.8% females. Similar patterns were found in three quadrants in 22.7% males and 9.6% females. Similarities in two quadrants were found in 31.03 % males and 22.7% females.

There are various types of distribution of lip print patterns in the different lip quadrants, but highest numbers of cases in both male and female category are seen as, "same print pattern in two quadrants" and lowest as "different print in all four quadrants". But there is always a strong relation between these patterns in various quadrants in either sexes ($R= 0.778$).

It can thus be said that lip prints with its uniqueness may serve as an important tool in personal identification.

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