Establishing cheiloscopy as a tool for identification: an assessment on 500 subjects in central India

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Abstract: *Objective*: Human identification is a universal process of certification of death and for personal, social and legal reasons. Aim of this study is to check whether there are any peculiar / common lip patterns among males and females and to establish lip prints as a tool for identification. *Background:* The present study was conducted among 500 subjects, aged 1-70 years. *Method*: The lip-imprints were taken by researcher no. 1 on a simple bond paper after applying lip stick evenly. Analysis of different patterns was done by researcher no.2 to avoid bias. *Results:* 229 male out of 250 and 226 female out of 250 were positively identified. Type I, I', II patterns were most commonly seen among female, while type III and IV lip patterns were most predominantly seen among males and type II lip pattern was present in both sexes. *Conclusion:* Lip prints are unique and do not change during the life of a person. So it can be taken as one of the person identification tool. **Keywords:** lip prints; human identification; cheiloscopy.

Introduction

Identification of a person is one of the most important part of medico legal field. It is based on certain physical characteristics unique to that individual. The basic motto is fixation of the individuality of a person. Like DNA fingerprinting & Dactylography, the uniqueness of prints of human lips have been noticed & study of lip prints has come up as an important aspect.

Cheiloscopy- the study of lip prints is easier to perform, very helpful due to its unique pattern & often more helpful in criminal investigations when other identification methods or parameters are either not available or difficult to analyse. The interesting aspect of cheiloscopy is- as has been pointed out, that the wrinkles & cracks of the lips specifically maintain the uniqueness & stability when the question of sex determination or fixation of identity of that person comes. Study shows that lip print pattern does not change even as age advances [1].

Cheiloscopy bears special importance when the sign of criminology is thought of. It has been seen that criminals are still not much aware of this part of identification, which often makes them exposed to investigating officer. In this connection more detail study of lip print has definite importance that obviously will add another feather in the crown of forensic science. Considering all these aspects, the study of such important physical property bears real requirement in today's scenario of litigation, medico legal disputes & rising criminal activities among the population.

Material and Methods

The study was conducted on 500 subjects of both sexes aged between 1 year to 70 years at Department of Forensic Medicine of the Institute. The subjects were selected by taking detailed information about and prior informed written consent was obtained from the subject. The lip prints were collected from the subjects visiting to the medical college, medical students and subjects living in the vicinity of the medical college, using the convenient sampling methodology. The lip-imprints were taken by researcher no. 1 on a simple bond paper after applying lip stick evenly. Analysis of different patterns was done by researcher no.2 (me) to avoid bias. The subject was included or excluded, as per inclusion and exclusion criteria mentioned below.

Inclusion criteria: The subjects having healthy lips and willing to participate in the study.

Exclusion criteria: Subjects with pathology like malformation, deformity, inflammation, trauma and surgical scars on lips, history of allergy to lipstick or generalized skin allergy.

Materials used in the study: Dark coloured lipstick, Bond paper (7cm x 5cm), Marker, Image scanner, Adobe® Photoshop® 7.0 Software, Card board (7cm x 5cm)

Method for analysis of lip prints: The lip-prints hence obtained were scrutinized for quality and samples which were not clear, incomplete or smudged were declared unsuitable. The lip-prints were scanned using an image scanner set at a resolution of 200 ppi. The images so obtained were magnified and studied using Adobe Photoshop 7.0 software. A horizontal line was drawn to distinguish the upper lip from the lower lip (y-y'), and another vertical line to divide the each lip into left and the right side (x-x'), these two lines intersected at right angles making four quadrants namely

1. Right Upper quadrant. (First Quadrant)
2. Left Upper quadrant. (Second Quadrant)
3. Left Lower quadrant. (Third Quadrant)
4. Right Lower quadrant. (Fourth Quadrant)

The lip prints so obtained were studied using the classification proposed by Suzuki and Tsuchihashi [2-3]. The classification is as follows:

- Type-I: A clear cut groove running vertically across the lip
- Type-I: Partial length groove of type-I
- Type-II: Branched groove
- Type-III: An intersecting groove
- Type-IV: A reticular pattern

Following pattern on thick bond paper was devised by Researcher no. 1, for collection of lip print and coding was done. For example:

Code	Lip Print	Name	Sex
A-1	Actual lip print	ABC	Male

Paper was passed by Researcher no. 1 to Researcher no. 2 contains only:

Code	Actual Lip Print
A1	
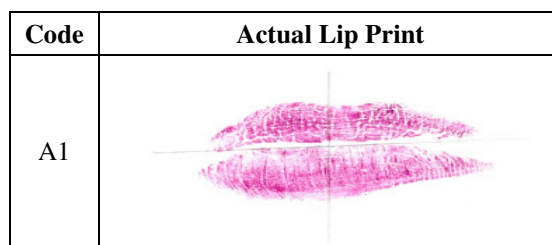
Researcher no. 2 who is forensic expert analysed and interpreted this coded paper, and the configuration of each quadrant and the most common lip pattern in that quadrant was noted- Configured and tabulated as:

Code	Lip Print Configuration		Sex Determination
A1	III III II (III)	II II III (II)	MALE
	I I' I (I)	III III I' (III)	

This coded paper was then decoded and these finding were separately entered in Microsoft excel sheet and analyzed with the help of statistician.

Statistical method applied: The entered data were analysed using Statistical Package for Social Science (SPSS) version 14. The p-value was taken as significant when less than 0.05 (Confidence interval of 95% was taken). The Chi- Square Test was used to compare the proportions.

Results

Table-1: Identification of Males and Females among study group using cheiloscopy					
	Male*	**Female***	**Undecided**	**Wrong Diagnosis**	**P value**
Actual	250	250	-	-	0.00*
Researcher no.2	229 (91.6%)	226 (90.4%)	22 (4.4%) out of 500	23 (4.6%) out of 500	
* p<0.05					

- In the present study 229 (91.6%) out of 250 males and 226 (90.4%) out of 250 females were positively identified, while 22 participants out of 500 (4.4%) were undecided whether it belongs to male or female and 23 participants out of 500 (4.6%) were wrongly identified.
- Among the total study group males were more positively identified and when compared with female the difference was statistically significant (p<0.05).

Table-2: Overall Common Lip Pattern among Males and Females (2000 Quadrants)			
Type of Lip Pattern	Male	Female	Total
Type I	80 (8%)	330 (33%)	410 (20.5%)
Type I′	80 (8%)	270 (27%)	350 (17.5%)
Type II	210 (21%)	350 (35%)	560 (28 %)
Type III	370 (37%)	50 (5%)	420 (21%)
Type IV	260 (26%)	0 (0.0%)	260 (13 %)
Total	(100%) 1000	(100%) 1000	(100%) 2000

In the present study common lip pattern was calculated by considering all the four quadrants among 500 subjects i.e. total 2000 quadrants. It was recorded that in males, 80 (8 %) had Type I lip pattern, 80 (8 %) with Type I′, 210 (21 %) with Type II, 370 (37 %) with Type III, 260 (26 %) with Type IV. In females 330 (33 %) had Type I lip pattern, 270 (27 %) with Type I', 350 (35 %) with Type II, 50 (5 %) with Type III, while Type IV lip pattern was absent among female and Type V was totally absent among study groups. Present study found that, Type III lip pattern [370 (37 %)] most commonly seen among males and Type II among female [350 (35 %)], While Type II lip pattern [560 (28 %)] seen predominantly among both gender.

Common Lip Patterns among study group in:

Table-3: First Quadrant (RUQ)			
Types*	Sex		Total
	Male	Female	
Type I	21 (8.4%)	99 (39.6%)	120 (24.0%)
Type I'	2 (0.8%)	16 (6.4%)	18 (3.6%)
Type II	94 (37.6%)	129 (51.6%)	223 (44.6%)
Type III	133 (53.2%)	6 (2.4%)	139 (27.8%)
Type IV	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	250 (100.0%)	250 (100.0%)	500 (100.0%)
* p<0.05			

Table-4: Second Quadrant (LUQ)			
Types*	Sex		Total
	Male	Female	
Type I	29 (11.6%)	71 (28.4%)	100 (20.0%)
Type I'	17 (6.8%)	58 (23.2%)	75 (15.0%)
Type II	23 (9.2%)	101 (40.4%)	124 (24.8%)
Type III	165 (66.0%)	20 (8.0%)	185 (37.0%)
Type IV	16 (6.4%)	0 (0.0%)	16 (3.2%)
Total	250 (100.0%)	250 (100.0%)	500 (00.0%)
* p<0.05			

Table-5: Third Quadrant (LLQ)			
Types*	Sex		Total
	Male	Female	
Type I	4 (1.6%)	81 (32.4%)	85 (17.0%)
Type I'	13 (5.2%)	89 (35.6%)	102 (20.4%)
Type II	10 (4.0%)	62 (24.8%)	72 (14.4%)
Type III	157 (62.8%)	18 (7.2%)	175 (35.0%)
Type IV	66 (26.4%)	0 (0.0%)	66 (13.2%)
Total	250 (100.0%)	250 (100.0%)	500 (00.0%)
* p<0.05			

Table-6: Fourth Quadrant (RLQ)			
Types*	Sex		Total
	Male	Female	
Type I	11 (4.4%)	84 (33.6%)	95 (19.0%)
Type I'	18 (7.2%)	44 (17.6%)	62 (12.4%)
Type II	39 (15.6%)	114 (45.6%)	153 (30.6%)
Type III	64 (25.6%)	8 (3.2%)	72 (14.4%)
Type IV	118 (47.2%)	0 (0.0%)	118 (23.6%)
Total	250 (100.0%)	250 (100.0%)	500 (100.0%)
* p<0.05			

In present study it was recorded that,

- *Type I lip pattern:* 21(8.4%) males had Type I in 1st quadrant, 29 (11.6%) in 2nd quadrant, 4 (1.6%) in 3rd quadrant, 11 (4.4%) in 4th quadrant. Among females, 99 (39.6%) had Type I lip pattern in 1st quadrant, 71 (28.4%) in 2nd quadrant, 35 (33.3%) in 3rd quadrant, 84 (33.6%) in 4th quadrant.

- *Type I' lip pattern:* 2 (0.8%) males had Type I' in 1st quadrant, 29 (11.6%) in 2nd quadrant, 13 (5.2%) in 3rd quadrant, 18 (7.2%) in 4th quadrant. Among females: 16 (6.4%) had Type I' lip pattern in 1st quadrant, 58 (23.2%) in 2nd quadrant, 89 (35.6%) in 3rd quadrant, 44 (17.6%) in 4th quadrant.

- *Type II lip pattern:* 94 (37.6%) males had Type II in 1st quadrant, 23 (9.2%) in 2nd quadrant, 10 (4.0%) in 3rd quadrant, 39 (15.6%) in 4th quadrant. Among females: 129 (51.6%) had Type II lip pattern in 1st quadrant, 101 (40.4%) in 2nd quadrant, 62 (24.8%) in 3rd quadrant, 114 (45.6%) in 4th quadrant.

- *Type III lip pattern:* 133 (53.2%) males had Type I in 1st quadrant, 165 (66.0%) in 2nd quadrant, 157 (62.8%) in 3rd quadrant, 64 (25.6%) in 4th quadrant. Among females: 6 (2.4%) had Type I lip pattern in 1st quadrant, 20 (8.0%) in 2nd quadrant, 18 (7.2%) in 3rd quadrant, 8 (3.2%) in 4th quadrant.

- *Type IV lip pattern:* among males, was totally absent in 1st quadrant, while it was 16 (6.4%) in 2nd quadrant, 66 (26.4%) in 3rd quadrant, 118 (47.2%) in 4th quadrant. Among females this type of lip pattern was not seen.

Among male and female, all the types of lip patterns and their distribution in different quadrants of lip were compared and the difference in distribution was found statistically significant (p<0.05).

Discussion

Uniqueness of Lip prints: In the present study, it was noticed that no two individuals or more than two individuals have similar type of lip prints. This observation was similar to the observations reported by many other workers including Suzuki

and Tsuchihashi (1970) [2-3], Tsuchihashi (1974) [4], Kasprzak (2000) [5-7], William (1991) [8], Vahanwala et al (2000) [9], Saraswathi et al (2009) [10], Sharma et al (2009) [11-12] and Jaishankar et al. (2010) [13]. No controversial statement in this respect has been observed by any other worker.

Identification of sex among the study group using cheiloscopy: In the present study 229 (91.6%) out of 250 males and 226 (90.4%) out of 250 females were positively identified. In a study conducted by Vahanwala et al (2005) [18] all 30 (100%) females were correctly identified whereas out of 20 males, 16 (80%) were positively identified.

Common lip pattern among male and females		
Sl. No.	Previous studies	Order of frequency of lip print patterns
1.	Suzuki and Tsuchihashi (1970) [2]	III> I> II> IV
2.	Vahanwalaand Parekh (2000)[9]	I> I'> II> IV> III
3.	Augustine et al (2008)[14]	III> II> IV> I> I'
4.	Gondivkar et al (2009)[15]	II> III> I> I'> IV
5.	Gopichand et al (2010)[16]	III> I> II> IV> I'
6.	Patel et al (2010)[17]	II> I'> I> IV> III
7.	Narang et al (2011)[18]	III> I> I'> IV> II
8.	Present study (2012)	II> III> I> I'>I V

Common lip patterns among males and females in different quadrants of lip			
Sl. No.	Previous studies	Order of frequency of lip print patterns	
1.	Saraswathi et al (2009) [10]	RUQ	III> I> II> IV
		LUQ	III> II> I> IV
		RLQ	III> II> I> IV
		LLQ	III> II> I> IV
2.	Present study (2012)	RUQ	II> III> I> I'> IV
		LUQ	II> III> I> I'> IV
		RLQ	III> I'> I> II> IV
		LLQ	II> IV> I> III> I'

The stability of lip pattern characteristics over time: Out of total 500 subjects 300 subjects were traced and their lip prints were recorded quarterly (each time in different season). Hence over a period of two years, lip prints each individual was recorded six times. The patterns of the vermilion zone were shown to be stable with the passage of time. Features of the lip print relative to the surrounding anatomy were also examined and found to be stable, recordable and to contribute to the usefulness of lip prints as a forensic tool. The number of matching features needed to prove concurrence between two prints was determined to be five. These are-

1. General appearance of the lips.
2. Philtrum.
3. Pecularities.
4. Print surface.
5. Vermillion patterns.

Conclusion

1. In present study, 229(91.6%) out of 250 males and 226(90.4%) out of 250 females were positively identified.
2. It was found that, Type III lip pattern was most commonly seen among males i.e. in 370 out of 1000 quadrants studied (37 %) and Type II lip pattern among females i.e. 350 out of 1000 quadrants studied (35%).
3. It was recorded that Type II lip print was found to be more frequent among both the genders.
4. The analysis of presence of lip print in each quadrant among 500 studied subjects shows that the most common lip print pattern is
   - Upper right quadrant of male lip was Type III [133 (53.2%)], while Type II was found among [129 (51.6%)] females.
   - In upper left quadrant Type III was found among [165 (66%)] males, while Type II was found among [101 (40.4%)] female,
   - In lower left quadrant among the male lip Type III [157 (62.8%)] was mostly seen,while in female it was Type I' [89 (35.6%)].
   - In lower right quadrant of male showed Type IV [118 (47.2%)], while Type II [114 (45.6%)] was found among female

This study concluded beyond doubt that lip-prints are a constant anatomical structure and are absolutely unique to an individual and thus are an infallible means of personal identification, if collected and analysed carefully. Hence, it can be assumed that time has come when lip-prints and similarly other new age evidence systems should to developed for criminal investigations and personal identification to take the existing systems to new heights of accuracy and dependability. It was found that, there was no similarity of lip prints from one individual to another individual in similar sex. No similarity of lip prints between one age group to another age group was noticed. With reference to sex, lip prints vary from males and females in each age group and no similarity was seen, between age groups of males and females. Lip print remains as a constant anatomical structure at all times but lip pattern varies from one quadrant to another quadrant. These observations establish that every individual has got unique lip print, if ante mortem record is available, it can be compared with post-mortem record for personal identification. This could be done by either comparing lip print in total or in compartment wise.

New techniques have been evolved like photograph, magna brush technique, chromatography, aluminium powder, cobalt oxide and lysochromes reagents can be used to trace the latent lip prints on skin, clothes and other non-biological suspected materials on the scene of crime. Further detailed study is required to find out the feasibility and validity of these new techniques. With this suggestion it is concluded that based on the observation of the study, lip print will be very useful in personal identification.

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