

Lip print patterns: Similarities among the parents and their children

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Abstract

Background: The wrinkles and grooves visible on the lips form the characteristic pattern of an individual and imprints produced is termed as “lip print.” The study of these prints is known as “cheiloscopy.” Variations in patterns among males and females could help in sex determination. Lip prints, therefore, can constitute material evidence left at a crime spot, equivalent to fingerprints. These patterns are heritable and are believed to be unique and permanent. The lip prints of parents and children and those of siblings have been shown to have some similarities. The influence of inherited lip print patterns among family members is still a new concept and studies are scanty in literature.

Objectives: The objectives are to determine the most common patterns and gender-wise distribution among the study population and to analyze the inherited lip print patterns from parents to their offspring.

Materials and Methods: Lip prints of 30 families were obtained using lipstick and cellophane tape. Based on criteria given by Suzuki and Tsuchihashi, patterns were recorded and analyzed from four quadrants of the lips using a magnifying lens.

Results: The positive resemblance of lip print patterns from parents to their offsprings showed statistically significant resemblance in one quadrant and rest of the three quadrants showed no significant association between parents and offspring.

Conclusion: Positive resemblance among the family members can be attributed to the genetics and inheritance. Lip print can be considered as an auxiliary method of identification.

Keywords: Cheiloscopy, family lineage, inheritance, lip prints, personal identification

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INTRODUCTION

Identification of an individual is becoming progressively more important in legal, medico-legal, civil and criminal investigations and as genetic explore in medical laboratories. Identification of a person alive or deceased is mainly based on the hypothesis that each individual is unique. The various methods involved in personal identification

are Anthropology, DNA fingerprinting, blood group identification and lip prints.^[1] Lip prints are considered to be analogs to fingerprints which are unique to every individual.^[2] The physiological wrinkles and grooves that are present on the vermillion border of lip forms a specific pattern. The variation in these patterns makes it individualistic. The study of these lip prints is known as

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cheiloscopy. It is derived from a Greek word “cheilos” meaning “lips” and “skopein” meaning “to see.”^[3] Lip prints are eternal as it is unchanged throughout the life of a person. It has been confirmed that they recover after undergoing alterations such as trauma, inflammation and diseases like herpes. Studies have been shown that environmental factors do not affect the lip print pattern.^[4]

The acceptance of lip prints as affirmative means of personal identification by “court of law” has extended the scope of cheiloscopy in forensic odontology. Therefore, lip prints can form a material of evidence at a topographic crime spot, corresponding to fingerprints. Pattern variations among males and females have major role in sex determination.^[5] These lip prints have been shown to have some similarities among the family members. Mc Donell was first person to conduct a study on lip prints of monozygotic twins in 1972 and reported that two identical twins seemed to be indistinguishable by every other means, but their lip prints were not identical.^[6] It has been accomplished that lip print patterns are inherited; it can be implemented in determining familial lineage and personal identification.^[7] The influence of inherited lip print patterns among family members is an upcoming concept and very few studies were found in literature. Therefore, the present study was carried out to determine whether there exists any similarity of lip print patterns among the family members.

Objectives

1. To determine the most common lip print pattern among the study group
2. To evaluate the gender-wise distribution of lip print patterns among the study population
3. To analyze the inherited lip print pattern between parents and their offspring (from parents to their children).

MATERIALS AND METHODS

Materials used for the study are shown in [Figure 1].

Sample

The cross-sectional study was conducted among 30 families comprising of total 110 individuals which included 50 males and 60 females. Family consisting minimum of three member’s father, mother, and children were considered in the study.

Inclusion criteria

1. Minimum family size of three with father, mother, and children (can be son or daughter)
2. All healthy individuals with no genetic disease.

Exclusion criteria

- a. Individuals with known hypersensitivity to lipsticks
- b. Individuals with active lesions on the lip
- c. Inflammation of the lips
- d. Trauma, malformation, or deformity of lips
- e. Any surgical scars or burns on lips.

Materials used

- a. Dark-colored lipstick (matte finish)
- b. Cellophane tape
- c. White bond sheet
- d. Magnifying lens
- e. Disposable brush for applying lipsticks
- f. Scissors.

Methodology

A written informed consent was obtained from each individual. In case of minor, consent was taken from either of their parents.

Lips were cleansed with wet cotton and allowed to dry. Lip prints of the subjects were collected using the lipstick method, in which a thin layer of lipstick was applied on the clean, dry lips using a disposable brush. The subjects were asked to rub both the lips so that lipstick was spread evenly throughout the surface of lips. The cellophane tape was applied on the lips with the glue surface towards the lip. Gentle pressure was applied over the lips from one corner of the mouth to the other end so that no smudge marks are produced. Later, this cellophane tape was carefully removed from one corner of the mouth and then placed over the white bond sheet. All the relevant data relating to its identity was written on the paper priorly. The lip prints of each subject were divided into four quadrants, i.e., two compartments on each lip, and were allotted the digits 1 to 4 in a clockwise



Figure 1: Materials used

sequence starting from subject's upper right as shown in the diagram [Figure 2].

Impressions were visualized using magnifying lens. The lip prints were analyzed and recorded according to Suzuki and Tsusuchiachi classification^[8] [Figure 3].

RESULTS

The data were compiled and results were drawn.

Data entry and statistical analysis were done using software SPSS 18.0 and R environment version 3.22 (Manufacturer Details SPSS Inc., Chicago, USA). Chi-square test was used to measure the strength of the association of lip print patterns between parents and their children. Significance is assessed at 5% level of significance.

The commonest lip print pattern in the study group was Type I (40.9%) and the least was Type III (4.5%). Type I being the common lip print pattern both in males and females. This study shows no gender predilection [Table 1 and Graph 1]. The lip print showed different patterns in each subject. The lip prints did not contain simply one type of pattern rather was a combination of varying types, which made it complex and unique. No two people possessed the same lip prints.

Table 1: Gender wise distribution of lip print patterns

Most common	Gender (%)		Total (%)
	Male	Female	
I	23 (46)	22 (36.7)	45 (40.9)
II	11 (22)	20 (33.3)	31 (28.2)
III	3 (6)	2 (3.3)	5 (4.5)
IV	7 (14)	14 (23.3)	21 (19.1)
V	6 (12)	2 (3.3)	8 (7.3)
Total	50 (100)	60 (100)	110 (100)

P=0.182, not significant, fisher's exact test

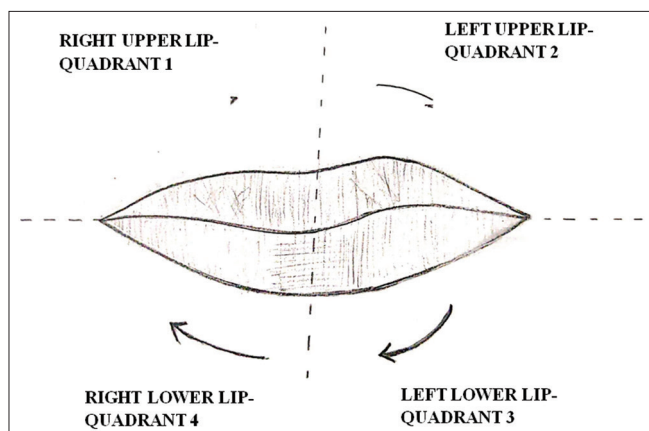


Figure 2: Division of lip prints into 4 quadrants

Although offspring had identical lip prints to their parents in one or more quadrants, in our study, the definable patterns were assigned in different locations forming unique characteristic patterns. Their placement was at different location. Therefore, the pattern created was slightly different from their parents. The positive resemblance of lip print patterns from parents to their offsprings was 61.4%. Statistically significant resemblance was found in one quadrant and rest of the three quadrants showed no significant association between parents and offspring[Table 2].

The positive resemblance of lip prints was found to be 58.3% between father and daughter from all four quadrants and 57.5% between mother and daughter. The association between father and mother to son was 34.16% and 30.8%, respectively [Table 3 and Graph 2].

DISCUSSION

Fischer in 1902 described the grooves and wrinkles of lip for the first time; later in 1932 Locard Edmond the greatest criminologist recommended its application as personal identification in criminal cases. Synder reported the description of lip prints in his book homicide investigation in 1950.^[9,10]

Suzuki in 1967 reported a detailed investigation on methods of extracting data from lip prints, color of rouge and

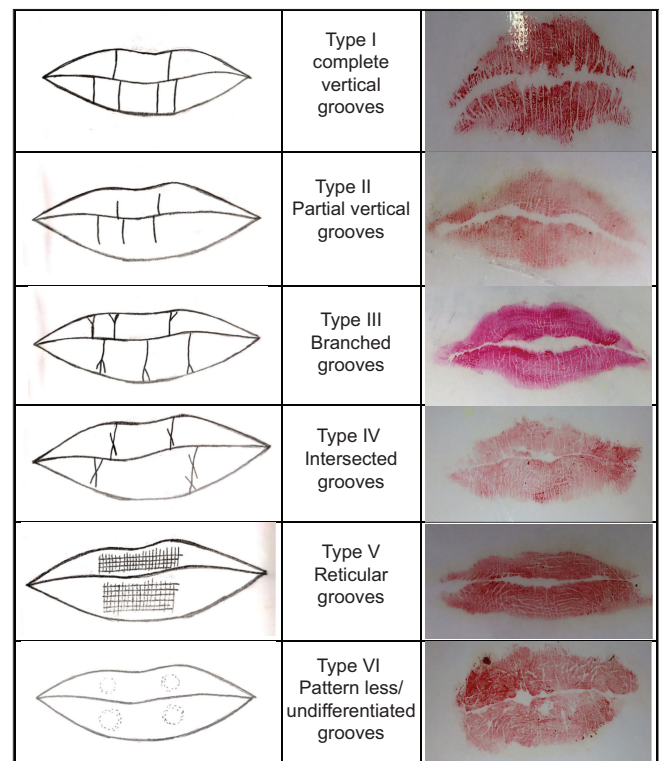
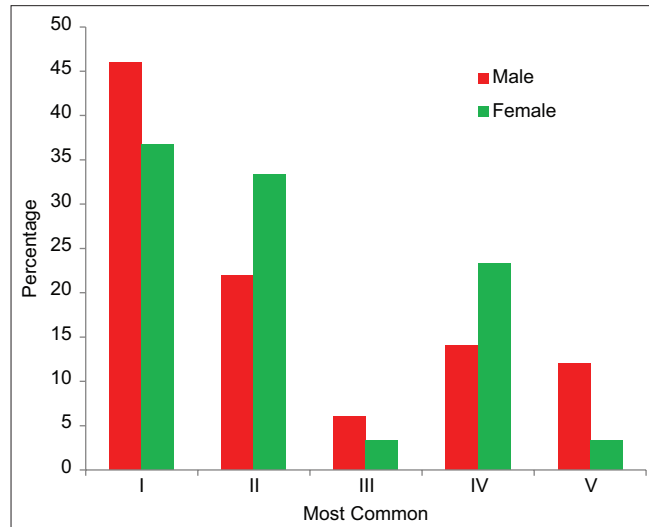


Figure 3: Suzuki and Tsusuchiashi classification

Table 2: Inheritance of lip print patterns from parents to offspring's

Quadrant	Father to son	Mother to son	Total	P	Father to daughter	Mother to daughter	Total	P
Right upper quadrant	10	9	19	0.087	20	14	34	0.119
Left upper quadrant	6	8	14	0.473	15	14	29	0.017*
Left lower quadrant	10	9	19	1.000	15	23	38	0.888
Right lower quadrant	15	11	26	1.000	20	18	38	0.792

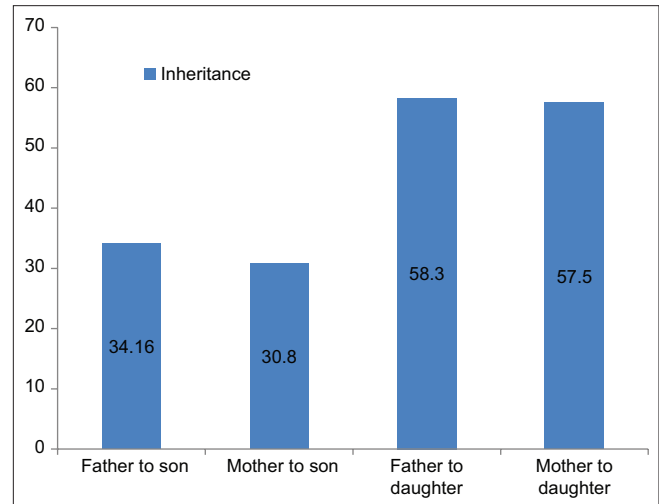
* P value <0.05 is Statistically significant

**Graph 1: Most common type of lip print**

measurement of lips.^[11] Later Suzuki and Tusuciachi in 1970 conducted a large study on 107 Japanese families and introduced the classification of lip print patterns which is followed throughout the world.^[8] Mc Donell in 1972 conducted a study on lip prints among identical twins and reported that they were indistinguishable by all means except for the variation in lip print patterns.^[6] Hirth *et al.* studied lip print pattern among 76 families and stated that the patterns are attributed to genetic factors.^[7] The study conducted by Schnuth, Jaishankar *et al.* on lip print patterns among the monozygotic twins, reported the pattern of lip prints were not exactly identical but some of the characteristics were inherited from either of the parents.^[3,12]

In our study, vertical lip prints (Type I groove) were more commonly seen followed by type II and type IV. This finding is in accordance with the earlier studies, by Vahanwahal and Parekh, Narwal *et al.* conducted in Indian population and George *et al.* in Malaysian's found type I as predominant pattern.^[13-15] Intersected pattern was common in a study conducted by Sivapathasundharam *et al.* in Indo-Dravidian population and in Japanese population by Tsuchihashi.^[1,4] These studies indicate that there exist a lot of regional variations among different populations.

In our study, type I was the most common pattern in males and females accounting for about 46% and 36.7%, respectively. It was found that there was no significant

**Graph 2: Inheritance of lip print patterns from parents to offspring's**

difference among gender ($P = 0.182$) which was in accordance with Augustine *et al.* where he did not find any significant difference in lip prints based on age, sex and race.^[16] In another study conducted by Sharma *et al.* and Satyanarayana *et al.* found that complete and incomplete vertical grooves to be predominant in females, undetermined pattern to be the most common in males and they had considered a central part of lower lip for analysis whereas in our study we had considered central part of upper and lower lip for analysis.^[17,18] In a study conducted by Tandon *et al.* it was found that the most common observed lip print in males was branched type, i.e., Type II and in females was vertical lip pattern, i.e., Type I.^[19]

Our study showed 61.4% resemblance between parents and children. This study indicates that there is an inheritance pattern of lip prints from parents to offspring. This finding is compatible with the results of various other studies. In a study done by Priyanka *et al.*, it was found that 83.3% resemblance between parents and offspring suggesting a strong inheritance.^[20] In studies done by Augustine *et al.* showed 63%, George *et al.* showed 58.6%, Devi *et al.* showed 37.66% all of which indicates inheritance of lip prints from parents to offspring's which was similar to our study.^[15,16,21] Vats *et al.* and Venkatesh *et al.* studied the lip prints of family members and between twins reported that the patterns were different on the whole with few similar grooves signifying the inheritance pattern.^[22,23] In contrast

Table 3: Resemblance among the family members

Inheritance	Father to son (%)	Mother to son (%)	Father to daughter (%)	Mother to daughter (%)
From all 4 quadrants	41 (34.16)	37 (30.8)	70 (58.3)	69 (57.5)

to our study, Maheswari and Gnanasundaram and Patel *et al.* studies showed that there was no familial or genetic similarity and tried to establish that there exists no similarity in lip prints between parents and their children and among twins or triplet.^[24,25]

The present study showed statistically significant relationship between lip print patterns of parents to daughters in the upper left quadrant (second quadrant). Other quadrants did not show any significant association between parents and children. These findings are in accordance with Narwal *et al.*'s study where one among four quadrants showed significant resemblance.^[14]

The resemblance was more between parents to daughters (58.3% and 57.5%) when compared to sons (34.15% and 30.8%). In our study, resemblance between fathers to offspring was 46.2% and mother to offspring was 44.5% which is in accordance with the study done by George *et al.* which was about 45.16% and 29.03%, respectively.^[15] Augustine *et al.* in his study showed positive resemblance between father to offspring was more compared to mother to offspring which was similar to our study.^[16] Miglani *et al.*'s study stated that the occurrence of lip prints is so variable that no factor (race, region, gender, inheritance) can be associated for the presence of any pattern of lip print and concluded that uniqueness of lip prints can dictate its importance in forensic investigations.^[26,27] Positive and significant correlation between parents and their offsprings indicate that lip print patterns have family lineage. Tsuchihashi and Suzuki, in their study, concluded that lip prints are unique and individualistic to each person, but the basic lip print patterns can still have some similarities between the family members, indicating the possibility of inheritance.^[1] Our study also found a marked similarity of lip print patterns among parents and children which can help in establishing the inheritance pattern among the family members and to determine the familial lineage of a person.

CONCLUSION

The positive resemblance of lip print patterns among family members may be attributed to the influence of inheritance. Based on studies available in literature and with our present study, lot of variations was found regarding

the positive resemblance among the family members; hence, inheritance of lip print alone cannot be considered to rule out the parent-child relationship or the family lineage and should/can be used as an auxiliary method of identification. However, further studies should/can be conducted on large samples of family members to draw a final conclusion.

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Conflicts of interest

There are no conflicts of interest.

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