

Distribution and Association of Lip Print Pattern, Finger Print Pattern and ABO Blood Groups in Relation to Gender and Family Among South Indian Population

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ABSTRACT

Background: Positive identification of living/ deceased using distinct traits is a cornerstone of forensic science. According to Locard's principle "When two objects come into contact, there is always transfer of material from one to another". The finger prints, lip prints and blood remains are the evidence for forensic identification.

Aim: To study the frequency, distribution and association of ABO blood groups, finger print pattern, lip print pattern among gender and also the inherent nature of patterns among family members.

Materials and Methods: A total of 200 Subjects (100 males, 100 females) within the age range of 17- 30 years and 20 families were randomly selected and aggregated as groups. Lip prints and finger prints were collected using dusting technique with fine carbon powder. ABO blood group was determined by slide agglutination method.

Results: Ulnar loop - Males - Vertical, Radial loop - Males - Branching, Whorl - Females - Branching, Arch - Males - Intersecting; Females - Vertical. O positive, B positive - Loop - Branching, A positive - Loop - Vertical and Intersecting, AB positive - Whorl - Branching and Intersecting. Among 20 families, 14 families showed 100 percent pattern resemblance. High percentage of similar pattern was observed between father to daughter (70%) in finger prints and mother to son in lip prints (71%).

Conclusion: Correlating the uniqueness of these physical evidence helps in personal identification as it can narrow the search & to substantiate the facts where there is little evidence.

Keywords: ABO blood groups, Dusting technique, Family, Finger print pattern, Gender, Lip print pattern

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INTRODUCTION

Individualizing a person or an object requires a combination of different procedures such as DNA comparisons, sex determination, post-mortem reports and differentiation by blood groups, finger prints, lip prints, palatal rugae pattern, bite marks, etc.¹ Positive identification of living/ deceased using distinct traits is a cornerstone of forensic science. According to Locard's principle, "When two objects come into contact, there is always transfer of material from one to another". The advantage of using fingerprints is its uniqueness and consistency once formed. The ability for its retrieval is attributed to the presence of non-volatile inorganic component of eccrine secretion which has been shown to remain intact even when exposed to temperatures as high as 600°C.² Just like finger prints and teeth, the lip prints remain uniform throughout the life and these characteristics of a person can be used to verify their presence or absence in the crime.³ Correlating the uniqueness of these physical evidence (finger print pattern, lip print pattern and ABO blood group) helps in individual identification as it can narrow the search, support and provide the facts where there is little evidence. Lip print and finger print patterns of parents and children and those of siblings have shown some similarities as these are considered to be genetically determined. So these features can be helpful in personal identification and determining the familial lineage of a person.⁴ The present study

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aimed to observe the frequency of distribution and association of finger print pattern, lip print pattern and ABO blood groups among gender and family members.

MATERIAL AND METHODS

Data was collected from the students of KSR Institute of Dental Science and Research, and also from families randomly from various districts of Tamil Nadu, India. The present study comprised of 200 subjects who belonged to the age group of around

17-30 years and 20 families (Families with father, mother and all the siblings). Individuals with any hand & lip deformity like permanent scars, any hematological & congenital disorders, smoking habit or those under orthodontic treatment were excluded. After obtaining the clearance from ethical and research committee, the subjects were informed about the procedures and consent was obtained.

ABO blood group of an individual was determined by using ABO blood grouping method (slide agglutination method). Finger prints and lip prints were recorded as latent prints by pressing the fingers and lips against the microscopic glass slides and developed by using fine carbon powder. Later, they were transferred to the white sheet by lifting the prints with transparent adhesive tape. Magnifying lens was used to visualise the recorded prints. Finger prints of four fingers (R. thumb & index, L. thumb & index) were observed and the patterns were analysed using Henry's system of classification (Loop pattern- ulnar & radial loop; Whorl pattern - double loop, central pocket, plain whorl; Arch pattern- plain & tented arch). Lip print patterns were classified based on Suzuki and Tsuchihashi's system (Complete & Incomplete vertical, Branching, Intersecting, Reticular, Undetermined). Finger prints and lip prints obtained using dusting technique shown (Figs.1 and 2). The present study is a cross-sectional study in which the distribution & association of the lip print, finger print patterns and blood groups were observed and analysed using Chi-square test.

RESULTS

O positive and B positive groups found to be the most predominant blood group type among 200 participants and the least common were A negative and B negative. None of them belonged to AB negative. Loop pattern (50.5%) was the most common finger print pattern in both the gender followed by whorl (44.5%) and least common is arch (5%) pattern. Males were found to have a greater number of loop pattern compared to whorl pattern, whereas females were found to have almost equal distribution of loops and whorls. Equal numbers of arch pattern were seen among both male and female participants. Increased incidence of loops in O and A positive, whorls in B and AB positive and arches in O and B blood groups were seen. In loop carrying individuals, AB positive only had radial loops.

Type II (branching) lip print pattern were found to be more common among females when compared to males and Type I' & Type III (incomplete vertical & intersecting) were found to be common among males when compared to females. Reticular pattern was only observed among males. O positive and B positive blood groups showed a greater number of branching and vertical lip print pattern, A positive and AB positive blood groups showed almost equal number of intersecting and branching patterns whereas A negative blood group had only vertical lip print pattern.

Table 1: Distribution of finger print patterns and lip print patterns among gender

Finger print pattern	Lip print pattern									
	Vertical		Branching		Intersecting		Reticular		Undermined	
	M	F	M	F	M	F	M	F	M	F
Ulnar loop	21	8	4	24	8	5	-	-	1	-
Radial loop	1	3	17	4	2	4	1	-	-	-
Whorl	7	11	20	21	13	14	-	-	-	1
Arch	1	3	1	-	3	1	-	-	-	1

Table 2: Association of finger print pattern, lip print pattern and ABO blood group

Lip print	Finger print	Blood group						
		Rh positive				Rh negative		
		O	A	B	AB	O	A	B
Vertical	Loop	13	9	7	1	1	2	-
	Whorl	4	1	10	1	2	-	-
	Arch	2	-	2	-	-	-	-
Branching	Loop	25	7	16	1	-	-	-
	Whorl	14	7	16	4	-	-	-
	Arch	-	-	1	-	-	-	-
Intersecting	Loop	3	8	4	1	1	-	2
	Whorl	6	7	11	3	-	-	-
	Arch	2	-	1	-	-	-	1
Reticular	Loop	-	-	1	-	-	-	-
	Whorl	-	-	-	-	-	-	-
	Arch	-	-	-	-	-	-	-
Undermined	Loop	-	1	-	-	-	-	-
	Whorl	-	1	-	-	-	-	-
	Arch	1	-	-	-	-	-	-

The observations of order of frequency for finger print and lip print patterns in relation to gender showed that majority of male-subjects with ulnar loop finger print pattern had vertical lip prints and those with radial loop finger prints had branching pattern of lip prints. Most of the females with whorls showed branching lip prints. Male subjects with arch pattern commonly showed intersecting pattern and females had Vertical lip patterns (Table 1). Branching lip pattern was found to be most common among loops and whorls. The association of lip print and finger print patterns showed a statistically significant difference ($P = 0.02$).

Table 2 shows the association of patterns and blood groups. Most of the O positive and B positive individuals with loop finger pattern had branching lip pattern, A positive individuals with loop pattern showed vertical and intersecting lip patterns. Most of the AB positives with whorl finger prints showed branching and intersecting lip patterns.

There are about 17 out of 20 families with similar pattern observation, 14 families with 100 percent pattern reflection and 3 families with 50% and 3 families with no resemblance. Among 20, 13 families had single child and 7 families had siblings. Out of 13, 11 families had similar patterns. Total of around 27 offspring (sons-14; daughters-13) among 20 families showed 61.5 percent positive resemblance with either of the parents. The highest frequency of similar pattern of finger print was found between father and daughter (70%) followed by mother and son (64%) and the lowest frequency were seen between mother and daughter (46%) comparatively. Pattern resemblance was found to be high between mother and son (71%) followed by father and daughter (61%). No similar pattern was seen between mother and daughter and least similarity was seen between father and son (21%) in relation to lip prints (Table 3). Association of patterns among gender, blood group and family for lip prints showed statistically significant difference (Table 4).

DISCUSSION

Most of the previous studies were done using ink method (stamp pad) for finger prints and lip stick method for lip prints. There are only few studies in literature which used dusting technique by developing latent prints. The present study was one among the few studies to use dusting powder. Dusting technique brings out the reliability of pattern as forensic experts were used to be trained by these techniques to trace out the patterns.

The present study observed the finger print patterns in four

fingers (right thumb, right index, left thumb, left index) as these fingers are commonly used digitally, as in biometrics and also as latent prints of these fingers are often encountered during any forensic investigation.

The present study showed predominance of loop finger print pattern among males; almost equal distribution of whorl and loop pattern among females and equal distribution of arches among both the genders. This is in contrast with the study done by Deopa et al (2014), Desai et al (2013) and Rathee et al (2016), as males had higher incidence of whorls and also with Rajeshwar et al (2017), where arch patterns were observed to be slightly more common in males.⁵⁻⁸

Among loop carrying individuals, females showed higher frequency of ulnar loop than males. Arch pattern was found to be least common in both the genders. These findings were similar with Shukla et al (2016) and Chandrasekar et al (2016).^{9,10}

Whorls were found to be more in number when compared to other patterns among B positive and AB positive individuals. The frequency of loops and whorls were detected similarly in other studies by Bharadwaja et al (loops=A; whorls=AB), Mehta et al (loops=O; whorls= B). Arch was the least observed pattern and found only in O and B blood group. A similar observation was reported in the study done by Sangam et al (loops= O; whorls=AB; arches= B).¹¹⁻¹³



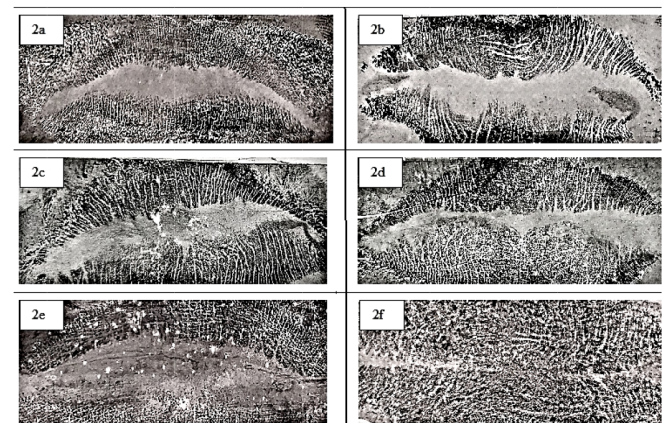
Figs.1a-1g: Finger print patterns using dusting technique [(a) Ulnar loop, (b) Radial loop, (c) Plain whorl, (d) Double loop, (e) Central pocket loop, (f) Tented arch, (g) Plain arch]

Table 3: Positive resemblance of lip prints and finger prints between family members

Family		Lip print	Finger print
Father	Son (14)	3(21%)	9(64%)
	Daughter (13)	8(61%)	9(70%)
Mother	Son (14)	10(71%)	9(64%)
	Daughter (13)	0	6(46%)

Table 4: Statistical analysis showing association between various groups

Probability value	Lip pattern	Finger pattern
Gender	0.05	0.2
ABO blood group	0.05	0.06
Family	0.00	0.2



Figs.2a-2f: Lip print patterns using dusting technique [(a) complete vertical, (b) incomplete vertical, (c) branching, (d) intersecting (e) reticular, (f) undermined]

While analyzing gender wise distribution of lip print patterns in the present study, branching (Type II) pattern was found to be the most common among females, followed by intersecting and vertical pattern (Type III > Type I, I'). In males it was intersecting (Type III) pattern, followed by Incomplete vertical (Type I') pattern. Similar findings of branching pattern being the most common among females and intersecting pattern being the most common among males have been reported previously in the studies by Kumar G.S et al (2012), Sharma et al (2014) and Karim et al (2014).¹⁴⁻¹⁶

Branching pattern was predominantly seen in O and B positive blood group which is consistent with the findings of Patel et al (2015).¹⁷ Branching and Intersecting pattern were almost in equal distribution among A positive and AB positive blood groups which was similar to that of the study by Karim et al (2014) in which intersecting pattern was reported more among A positive blood group.¹⁶ Telagi et al showed greater number of branching patterns among O and B positive individuals and intersecting pattern more in A positive individual.¹⁸

Association between lip prints and finger prints were observed in the present study. Branching and Vertical lip patterns were mostly associated with loops followed by whorls whereas, intersecting lip pattern was mostly associated with a greater number of whorls followed by loops. Arch finger print pattern showed almost equal distribution of vertical and intersecting lip patterns.

The finger print pattern, lip print pattern and ABO blood group were correlated in the present study. The results showed higher frequency of O positive blood group in both gender with almost equal distribution of loop pattern of finger print and branching lip print pattern followed by B positive females with whorl finger prints and branching lip prints. Male participants with A positive blood group mostly had loops and intersecting pattern and AB positive male participants had whorl and branching pattern.

There are about 27 offspring among 20 families, out of which 61.5% were seen to have positive resemblance with either of the parents. Lip prints were highly matched between fathers and daughters (70%), high resemblance was observed between mothers and sons (64%) and between fathers and sons (64%). Least resemblance was seen between mothers and daughters (46%). The study by Augustine et al stated that positive resemblance of lip prints of around 63% was observed with either of the parents. The order of higher frequency from father to son was followed by mother to son and then father to daughter. But the least resemblance was found between mothers and daughters, similar to the present study.¹⁹

17 out of 20 families who participated in the current study, showed similar pattern observation. A study by Ghalaut et al (2013) reported that 25 out of 30 families had similar patterns from either of their parents.⁴ Among the 20 families in the present study, 13 families had single child and 7 families had siblings. Out of 13, 11 families had similar patterns. In a study by Patel et al, 4 out of 10 families with single child showed similar pattern and the same dusting technique was used.²⁰

CONCLUSION

The observations of our study revealed that there is an association between finger print, lip print and ABO blood groups among gender and also the patterns among family members are inherited in nature. Lip prints were found to be more reliable and established a significant relationship among gender and different blood groups

and these remain useful in sex determination and individual identification. When combined with other investigative features, these evidences can serve to strengthen a diagnostic impression and can be advocated as a useful screening method.

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