Biometrics in twins

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Abstract:

Background: The study of the lip print and fingerprint patterns among twins can be used to determine the personal identification of the deceased and in criminal investigations. **Aim**: The aim was to evaluate the visible lip pattern and other biometrics in the Gujarat population and to ascertain the existence of the hereditary pattern followed among monozygotic and dizygotic twins. And analyze a connecting link between the lip print, fingerprint and blood groups, and other biometrics

Objective: This study is aimed to analyze the patterns of lips, fingerprints, and correlation with blood group in monozygotic and dizygotic twins. The objective is to study the variability and genetic basis of wrinkles present in the lip, fingerprint and blood group

Materials and Methods: 20 individuals (12 males and 8 females) were included in the study.4 pairs of monozygotic and 6 pairs of dizygotic twins were included

Result: A positive correlation was found between the fingerprint and lip print. No significant results were obtained when analyzing the correlation if blood group with fingerprint and lip print **Conclusion:** This study shall bring exhibit a connecting link between forensic odontology and forensic sciences. This shall aid the process of identification and study the similarities and differences in the different biometrics among the twins

Keywords: Blood groups, Cheiloscopy, Dermatoglyphics, Forensic, Twins

Introduction:

There are 7 different types of twins known, which include:

1) Mirror image twins
2) Half Identical twins

3) Half chromosome twins
4) Superfetation
5) Superfecundation
6) Fraternal twins
7) Identical twins

Human identification is the mainstay of civilization and the identification has always been of paramount importance. The traditional methods for personal identification include anthropometry, dactylography, sex determination, and differentiation by blood groups, DNA profiling, and odontology[1]. In addition to postmortem identification, dental evidence can be crucial in crime scene investigation[4]. The study of lip print patterns is known as cheiloscopy[1]. Lip prints were first described by Fischer in 1902 however, its recommendation to be used in personal identification and criminalization was given in 1932 by Edmond Locard[2,3]. The wrinkles and grooves of labial mucosa in an individual form a characteristic pattern called lip print[5].

Lip prints can be found on the surfaces of glass, clothing, cutlery and cigarette butts[7]. The second prints of interest, which are highly individualistic and forms the basis for personal identification. As there is immense potential for lip print and fingerprint, they are identified as an effective method for identification.

With the ever-increasing demands placed upon law enforcement to provide sufficient physical evidence linking the suspect to the crime, it makes sense but provides only substantial evidence. These shreds od evidence can provide information on the basis of the conclusion of the occupation, habits, sex and pathological change and hence narrow down the investigation. The present work is to determine any connecting link between lip print and thumbprint in order to provide an association for identification of the person at the crime scene(5)

Materials and methods.

The materials required for the study include:

1) Matte-finished dark-colored lipstick
2) Cellophane sheet

3) Pair of scissor

4) White paper

5) Scissor

The study sample comprised of 20 individuals from Gujarat with 12 males and 8 females ranging from 8 years and above

Lips and fingers free from any pathology were included in the study. The climatic conditions were also taken into consideration. Consent for the study was taken from all the individuals.

Lips prints and fingerprints were recorded and blood groups had been recorded based on blood reports taken by the subject previously

Technique:

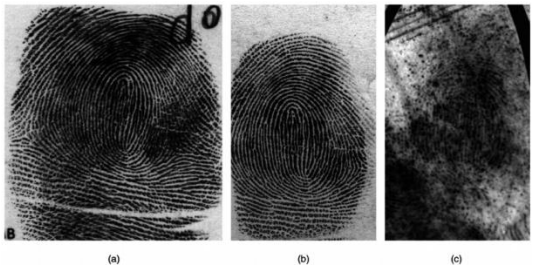
For recording the lip print:

A thin film of matte-finished red or brown colored lipstick was applied uniformly on the lips from the midline and moving laterally. The lips were allowed to dry. After which the lip impression was recorded on a cellophane tape. The subject was asked to make a lip impression in a normal rest position of the lip. The records were taken by dabbing the cellophane tape first in the center and then pressing uniformly towards the corner of the lips. The cellophane tape was then peeled off and pasted on a white sheet for further analysis. While analyses the various lip prints were divided into 6 compartments i.e. 3 parts of each lip. The digits 1-6 in a clockwise sequence starting from upper right quadrant were allotted

Recording of fingerprints

The thumb of individuals was cleaned and the blue ink was rolled over the thumb. The smeared thumb was then printed on the white paper below the lip print by using the roll technique from medially to laterally with moderate pressure

Primary patterns were visible.



Classification schemes

The patterns of lip- Tsuchihashi Y and Suzuki classification

Fingerprints- Michael kucken

Blood group- ABO blood grouping.

Lip print classification

The classification used for lip prints is given by Suzuki and Tsuchihashi that is most widely used[6], is as follows:

Type 1: A clear cut groove running across the lip

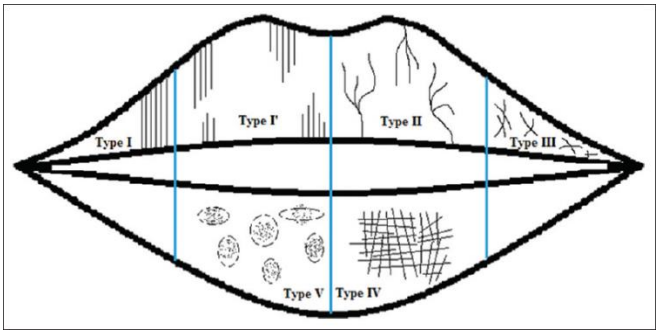
Type 1': Partial length groove of type 1

Type 2: A branched groove

Type 3: An intersected groove

Type 4: A reticular pattern

Type 5: Other patterns



Fingerprint classification:

Fingerprint classification of Michael Kucken was used

1) Whorl pattern
2) Loop pattern
3) Arch pattern

Blood group classification

ABO blood grouping system

RESULTS

For lip print:

The overall lip patterns and thumbprint patterns in 4 dizygotic twins and 6 monozygotic twins were analyzed. Here Type 2 pattern of lip print was dominant among both the pairs of (monozygotic and dizygotic) twins. Type 2 lip patterns was predominant in both pairs of twins with 61% in males and 70% in females, followed by Type 1 pattern, (38.4% in males and 30% in females), type 1' (30.7% in males ad 20% in females) and finally the type 3,4 and 5 patterns .

Type 2 lip patterns were found in 66.67% of monozygotic twins and 75% of dizygotic twins.

For thumbprint:

Loops pattern of the fingerprint was found to be the most dominant among the twin population with a percentage of 60% and was followed by whorls and arches

The loop patterns for fingerprint was found to be 66.67% in monozygotic twins and 50% in dizygotic twins.

For blood group:

Most dominant blood group among the pairs is B+ve (55%)

It was followed by the blood group O+ve (35%)

Correlation of lip prints and thumbprints

The overall correlation of lip prints with thumbprints in monozygotic and dizygotic twins. A correlation was found between lip and thumbprints and the following results were obtained.

In figure 1, Independent sample t-test revealed a significant difference ($p < 0.05$) in type 2 lip print pattern with thumbprint

In figure 2, the Pearson coefficient of Type 2 pattern of lip print showed a significant positive correlation with fingerprint ($p < +1$), suggesting Type 2 lip print pattern is significantly correlated with loop type fingerprint pattern

When seeing the correlation of lip print with blood groups no significant results were seen due to unequal distribution of samples. Even when relating blood groups and thumbprints no significant results were obtained due to unequal distribution of samples

		Levene's Test for Equality of Variances		Independent Sample t-test		
		F	Sig.	Df	Sig. (2-tailed)	Mean Difference
TYPE 1	Equal variances assumed	8.250	.010	18	.620	.582
	Equal variances not assumed			17.637	.540	.582
TYPE 1'	Equal variances assumed	.810	.380	18	.199	2.484
	Equal variances not assumed			10.545	.236	2.484
TYPE 2	Equal variances assumed	2.037	.171	18	.025	-5.055
	Equal variances not assumed			9.382	.054	-5.055
TYPE 3	Equal variances assumed	8.713	.009	18	.214	3.055
	Equal variances not assumed			7.915	.312	3.055
TYPE 4	Equal variances assumed	2.629	.122	18	.775	-.681
	Equal variances not assumed			8.182	.811	-.681
TYPE	Equal variances assumed	4.917	.040	18	.246	-1.154

		FINGERPRINT	TYPE 1	TYPE 1'	TYPE 2	TYPE 3	TYPE 4	TYPE 5
FINGERPRINT	Pearson Correlation	1	-.118	-.300	.499*	-.291	.068	.272
	Sig. (2-tailed)		.620	.199	.025	.214	.775	.246
	N	20	20	20	20	20	20	20
TYPE 1	Pearson Correlation	-.118	1	.204	-.022	-.001	-.037	.192
	Sig. (2-tailed)	.620		.389	.927	.996	.877	.418
	N	20	20	20	20	20	20	20
TYPE 1'	Pearson Correlation	-.300	.204	1	-.144	.054	-.307	-.072
	Sig. (2-tailed)	.199	.389		.544	.821	.188	.763
	N	20	20	20	20	20	20	20
TYPE 2	Pearson Correlation	.499*	-.022	-.144	1	.418	.157	.097
	Sig. (2-tailed)	.025	.927	.544		.067	.510	.683
	N	20	20	20	20	20	20	20
TYPE 3	Pearson Correlation	-.291	-.001	.054	.418	1	-.004	-.160
	Sig. (2-tailed)	.214	.996	.821	.067		.987	.499
	N	20	20	20	20	20	20	20
TYPE 4	Pearson Correlation	.068	-.037	-.307	.157	-.004	1	.075
	Sig. (2-tailed)	.775	.877	.188	.510	.987		.753
	N	20	20	20	20	20	20	20
TYPE 5	Pearson Correlation	.272	.192	-.072	.097	-.160	.075	1
	Sig. (2-tailed)	.246	.418	.763	.683	.499	.753	
	N	20	20	20	20	20	20	20

. Correlation is significant at the 0.05 level (2-tailed).

Figure 1

Figure 2

DISCUSSION

Identification of an individual is one of the most important goals for forensics. The use of conventional methods such as dactylography (the study of fingerprints) and cheiloscopy (the study of lip prints) is paramount importance since personal identification by other means such as DNA analysis is sophisticated and not available in rural areas of developing countries like India[8]. Lip prints can recover even after trauma, inflammation, and diseases such as herpes and can be recognized without difficulty [9].

In our study among males, the most common observed lip print is the branched type i.e. type 2

Although in some studies type 4 was the most predominant pattern[12,13,14]. Thakur *et al*. suggested that resemblance of lip print patterns among MZ twins and dizygotic twins revealed that MZ twins resembled more with each other than dizygotic twins and also found strong evidence of its inheritance[15]. Fernandes *et al*. also investigated that MZ twins presented a relevant percentage of cheiloscopy agreements and also suggested influence hereditary relationships on inherited cheiloscopic features [16]. Suzuki *et al*. and Hirth *et al*. also suggested in their study that twin families, mother/father and child combination proved a genetic basis of lip prints. This is concordance with our study. McDonell described two identical twins that seemed to be indistinguishable dentally, but lip print, handwriting and voice prints differed. Vahanwala and Pagare suggested that discrimination between a pair of identical twins can be made easy if lip prints assessed systematically and thoroughly. Hence, although the similarity percentage of identical twins is more than the nonidentical twins, still it is one of the important adjunct tools to solve forensic scenario[17]. Jain *et al*. studied the similarity of identical twin fingerprints found that a state-of-the-art automatic fingerprint verification system can successfully distinguish identical twins though with slightly lower accuracy than nontwins[18]. There was a positive correlation between lip print pattern and parents of both identical and non-identical twins, and it was found to be statistically significant, $P \leq 0.5$[19]

CONCLUSION

A positive correlation was established between lip print and fingerprint but no significant results were obtained when correlating blood group and fingerprints. Lip print, fingerprint and blood groups are the parameters being used for personal identification and hold high forensic significance. According to the results

obtained from the studies above we cannot use these as core evidence at crime but can definitely be used as substantial evidence. Hence further studies with more sample size are needed to establish proper correlation and study the pattern of inheritance.

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