

A Cross-Sectional Study of Lip Prints in a Bengali Population: Indian Scenario

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ABSTRACT

Aim: This study was carried out with the objectives of investigating and evaluating the uniqueness of lip prints and in particular lip print pattern identification among a population of Bengali individuals residing in Navi Mumbai, Maharashtra.

Materials and Methods: The lip prints of 100 subjects which included 50 females and 50 males in the age group of 13 to 70 years were selected for the study. The lip prints were analyzed using magnifying lens and were classified using the criteria given by Suzuki and Tsuchihashi. The print was subsequently visualized with the magnifying lens.

Statistical analysis used: Data was entered on a Microsoft excel sheet and statistically analyzed using statistical software (SPSS, version 17.0) (Chicago, Illinois, USA). Chi-square test was performed to test the significance of gender-wise difference in different quadrants. $P \leq 0.05$ was considered as statistically significant.

Result: The most predominant pattern seen in this population was type II, followed by type III, type V, type IV, type I and type I' in both the upper and the lower lips taken together.

Conclusion: The lip prints did not consist simply of one type of groove alone, but appeared as a mixture of varying types. Lip prints are unique for each individual and the lip prints among family members show different patterns with few similar grooves. Lip prints are highly individualistic which can be used for personal identification of individuals and can be of great use in future of forensic odontology.

Keywords: Forensic odontology, Bengali, cheiloscopy, lip prints.

INTRODUCTION

The fundamental and principles of clinical dentistry have, from time to time, shed light on questions of civil and criminal law. ^[1] Lip prints are traces of the normal lines and fissures in the form of wrinkles and grooves that appear in the transition zone of a human lip. ^[2] Cheiloscopy, the study of lip prints, is derived from the Greek words "cheilos", which means lips, and "skopein," which means "to

see". ^[3] It is the forensic investigation technique that deals with the identification of humans based on lip traces. Based on the specific arrangement of the lip lines, researchers introduced a new method of cheiloscopy to forensic odontology. Lip prints were first described by R. Fischer in 1902, while their uniqueness and stability were defined by Suzuki and Tsuchihashi in 1971 after intense research. Lip prints are unique and like fingerprints and palatal rugae do not change during the lifetime of an

Received: Apr. 19, 2017; Accepted: June. 9, 2017

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Fig 1. Procedure for carrying out the lip prints.



Fig 2. Lip prints transferred onto the registration sheets.

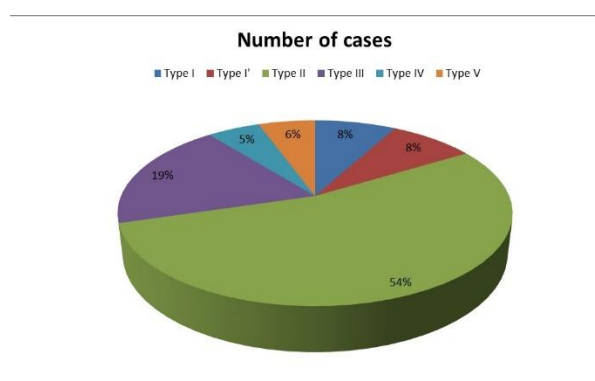


Fig 3. Pie chart showing total number of cases.

individual. Furthermore, lip grooves are permanent and unchangeable. [4, 5]

Lip prints do not change even after undergoing alterations like trauma, inflammation and diseases like herpes and that the form of the furrows does not vary with environmental factors. [4, 6, 7] The present study was carried out to

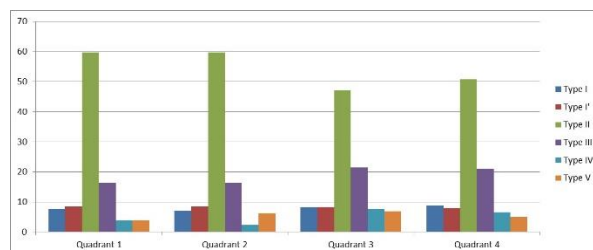


Fig 4. Quadrant wise comparison of lip prints in males.

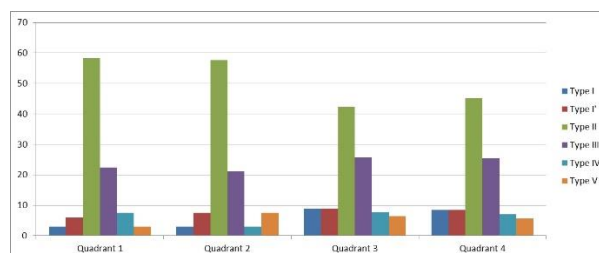


Fig 5. Quadrant wise comparison of lip prints in females.

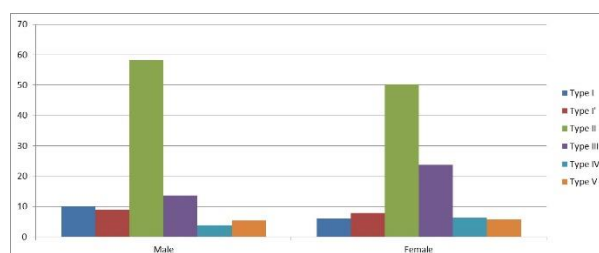


Fig 6. Distribution of lip prints irrespective of quadrant.

investigate and evaluate the uniqueness of lip prints and in particular to identify the lip print pattern in a Bengali population residing in Navi Mumbai, Maharashtra.

MATERIALS AND METHODS

The study population comprised 100 randomly selected individuals (50 females and 50 males) visiting the outpatient department of our institution for various dental ailments, and belonging to the Bengali ethnic group. The study population resided in urban localities of Navi Mumbai, and ranged in age from 13-70 years. Subjects with inflammation, ulcers, trauma, congenital developmental defects and malformation, deformity and surgical scars, and hypersensitivity to lipstick were excluded from the study. A written informed consent was taken from each of the subject and from their parents in case of

Table 1: Total number of cases.

	Total
Type I	43
Type I'	45
Type II	292
Type III	102
Type IV	28
Type V	30

Table 2: Quadrant wise comparison of Lip prints in Males

	Quadrant 1		Quadrant 2		Quadrant 3		Quadrant 4	
	Number of cases	Percentage	Number of cases	Percentage	Number of cases	Percentage	Number of cases	Percentage
Type I	8	12.90	7	11.11	5	7.58	6	8.96
Type I'	7	11.29	6	9.52	5	7.58	5	7.46
Type II	38	61.29	39	61.90	35	53.03	38	56.72
Type III	6	9.68	7	11.11	11	16.67	11	16.42
Type IV	0	0.00	1	1.59	5	7.58	4	5.97
Type V	3	4.84	3	4.76	5	7.58	3	4.48
Total	62	100	63	100	66	100	67	100

Table 3. Quadrant wise comparison of Lip prints in Females

	Quadrant 1		Quadrant 2		Quadrant 3		Quadrant 4	
	Number of cases	Percentage	Number of cases	Percentage	Number of cases	Percentage	Number of cases	Percentage
Type I	2	2.99	2	3.03	7	8.97	6	8.45
Type I'	4	5.97	5	7.58	7	8.97	6	8.45
Type II	39	58.21	38	57.58	33	42.31	32	45.07
Type III	15	22.39	14	21.21	20	25.64	18	25.35
Type IV	5	7.46	2	3.03	6	7.69	5	7.04
Type V	2	2.99	5	7.58	5	6.41	4	5.63
Total	67	100	66	100	78	100	71	100

Table 4: Distribution Of Lip prints irrespective of Quadrant.

	Male		Female	
	Count	Percentage	Count	Percentage
Type I	26	10.07752	17	6.028369
Type I'	23	8.914729	22	7.801418
Type II	150	58.13953	142	50.35461
Type III	35	13.56589	67	23.75887
Type IV	10	3.875969	18	6.382979
Type V	14	5.426357	16	5.673759
Total	258	100	282	100

Table 5: The observed, expected and Residual of the Male data.

	Observed N	Expected N	Residual
Type I	26	43.0	-17.0
Type I'	23	43.0	-20.0
Type II	150	43.0	107.0
Type III	35	43.0	-8.0
Type IV	10	43.0	-33.0
Type V	14	43.0	-29.0
Total	258		

Chi-square test:

Test Statistics	
Chi-Square	328.651 ^a
Df	5
p-value	.000
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 43.0.	

Table 6. The observed, expected and Residual of the female data.

	Observed N	Expected N	Residual
Type I	17	47.0	-30.0
Type I'	22	47.0	-25.0
Type II	142	47.0	95.0
Type III	67	47.0	20.0
Type IV	18	47.0	-29.0
Type V	16	47.0	-31.0
Total	282		

Chi-square test:

Test Statistics	
Chi-Square	271.319 ^a
Df	5
p-value	.000
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 47.0.	

minors. Ethical clearance was obtained from the ethical committee of the institution. The study was carried out over a period of 5 months.

Lips of the subjects were first cleaned thoroughly. The lips were then outlined using a sharp lip liner pencil (Brand Cameleon). Lipstick (Brand Colorbar) was applied uniformly to the lips using lipstick applicator brushes starting at the midline and moving laterally to avoid the smudging of the lipstick in the grooves. The lipstick was allowed to dry for about 2 minutes after which lip prints were taken in two ways. First, lip prints of each lip were taken separately using scotch magic tape. A thin coat of lipstick was reapplied and a second lip print of both the lips together was taken using cellophane tape [Figure 1].

The subjects were strictly advised not to change their position and to avoid any movement of the lips during the procedure of recording of the lip prints; as such changes could affect the accuracy of recording of the lip prints. The prints were stuck onto white paper with the details like the serial number and sex of the individual in a manner similar to that described by Sivapathasundaram et al (2001).^[4] Care was taken to avoid wrinkle formation while sticking the tape to the paper. The used lipstick brush applicator was washed with water, and the tips were immersed in an antiseptic solution and washed with water again prior to reuse.

Each lip print was divided into four quadrants (upper left, upper right, lower right, lower left). All lip prints were studied carefully with a magnifying lens. The classification used was the one proposed by Suzuki and Tsuchihashi [Figure 2].^[8]

• Type I: Complete vertical (end to end) longitudinal fissures

- Type I': Incomplete vertical fissures
- Type II: Branched 'Y' shaped pattern
- Type III: Intersected, criss-cross pattern
- Type IV: Reticular, fence-like or chequered pattern
- Type V: Irregular pattern.

Data was entered on a Microsoft excel sheet and statistically analyzed using statistical software (SPSS, version 17.0) (Chicago, Illinois, USA). Chi-square test was performed to test the significance of gender-wise difference in different quadrants. $p \leq 0.05$ was considered as statistically significant.

RESULTS

The most predominant pattern in the entire study population was Type II. This was followed by Type III, Type I', Type I, Type V and the Type IV (Table 1, Figure 3). When a quadrant wise comparison of the type of lip prints was done between the males and females it was observed that males showed 61.90% of branched pattern in the second quadrant while the females showed 57.58% of branched pattern in the second quadrant (Table 2, 3) (Figure 4, 5).

The most predominant pattern seen in females was Type II followed by Type III, Type I', Type IV, Type I, Type V. Predominant pattern seen in males was Type II followed by Type III, Type I, Type I', Type V, Type IV (Table 4, Figure 6). Type II was the predominant pattern irrespective of gender.

When the data of males was analyzed it was observed that the p-value for the chi-square was less than that of 0.05 indicating that the proportion of all the types was not equally distributed. The mode of the data was 150 for type II. The highest value of the residual in the Table 5 shows that the Type II is prominent in Indian male.

Similarly, when the female data was analyzed it was observed that the p-value for the

chi-square was less than that of 0.05 indicating that the proportion of all the types was not equally distributed. The mode of the data was 142 for type II. The highest value of the residual in Table 6 shows that the Type II with positive residual value of 95 and Type III with positive residual value of 20 which indicates that Type II is prominent in Indian female. No gender-wise difference was observed among the lip prints pattern. No statistically significant difference was found between the genders.

DISCUSSION

Forensic odontology can involve a dentist's participation in legal and criminal issues. The lip prints are developed at the 6th month of intrauterine life, unchangeable throughout the lifetime and are unique to each person. Cheiloscopy can be compared to fingerprint analysis and can act as a valuable evidence in a crime scene investigation.^[9] Lip prints which are not visible of those located on difficult surfaces can be seen with the help of various dyes such as aluminium powder, silver metallic powder, silver nitrate powder, fat black aniline dyes or cobalt oxide. ^[10] The Tsuchihashi's classification is the most frequently used classification as nearly all the lip patterns encountered fits into this classification and is easy to interpret.

In a study of lip print patterns on 20 males and 20 females, for identification of sex by lip prints, it was found that Type I and Type I' patterns were predominantly seen in females while Type IV pattern was predominantly seen in males.^[11]

In another study, it was observed that Type I was the most prominent pattern in boys followed by Type II, Type IV, Type I', Type III and Type V. In girls, Type II was the most prominent pattern followed by Type I', Type I, Type III, Type IV and Type V was the least common pattern.^[12] In a study on 50 male and 50 female subjects of Kerala origin on Lip Print Types, Type IV was most frequently observed in both the sexes and in both the quadrants. ^[13] In a study conducted in Pondicherry in India on 60 students (30 males & 30 females) in the age group of 17 – 25 years, it was found that type III was predominant in males, followed by type II, type IV, type I & type V patterns. In females type II was predominant pattern followed by type IV,

type I, type III & type V patterns.^[14] In a research study involving 100 lip prints of male & 100 lip prints of female, it was found that branched pattern (type III) was predominant in both sexes.^[15]

The most common pattern in a Libyan population was Type I among both the genders. A similar pattern was also seen in an Egyptian and a Punjabi Indian population where complete vertical pattern was common to both the genders. ^[16] In a study conducted on a Rajasthani population, the Type III lip pattern was seen in both the genders which coincided with similar studies done by Sivapathasundaram et al. in 2001, Augustine et al. in 2008 and Narang et al. in 2011. ^[17]

Vahanwalla and Parekh found Type I pattern predominance in a study on Mumbai population.^[18] However, a predominance of Type III pattern in Chennai,^[3] Type IV pattern in Kerala, and Type II pattern in an Indo-Chinese population,^[13] suggest the probable role of race or geographical distribution, on the specific pattern of lip prints.

In the present study, there was no statistically significant difference between males and females regarding any type of lip pattern and the sex could not be differentiated from the lip print. This was in accordance to the findings by Peeran SW et al. ^[16], Ragab et al. ^[19] in an Egyptian population and by Prabhu et al. ^[20] in a Goan Indian population.

Some researchers have worked on the lip print pattern to prove that gender differences exist in lip prints. Verma Y et al. did a recording of the lip prints after a six-month interval and matching it with the baseline (record of first day) which revealed a statistically insignificant change, probably implying that over a period of time, the pattern would remain the same. As the lip patterns do not change with time, this finding promises the use of lip prints in personal identification. ^[21]

Ample evidence exists in scientific literature to establish the fact that lip prints are unique and characteristic in an individual. Classifications are helpful to categorize lip prints and to narrow the range for a detailed investigation. It would help create an organized database for easy retrieval of information. Lip prints are essential as a basis for comparison, for instance, between

families and sexes. Items such as letters, photographs, cigarette butts, drinking glasses, cups, window panes etc. that could bear lip prints should be closely examined. An evidence of this kind carries a huge amount of information which may be used in the reconstruction of the events, establishing versions, checking them and identifying suspects. Postmortem identification has been done through lip prints. Lip prints have been analysed through numerous softwares. However, use of lip prints is still impeded by numerous limitations. More long term studies are required to substantially document the permanent nature of lip prints. Research is still in progress to develop advanced methods to capture lip prints at a crime scene. Complete utilization of lip prints depends to a large extent on the skill of members of law enforcement agencies. The limitations of cheiloscopy are relatively little known and thus, so far lip prints have been sparingly used despite their frequent presence at the crime scene. Cheiloscopy should be placed within the scope of criminalistics, side by side with dactyloscopy and other means of person identification. The subject of cheiloscopy should be introduced into the syllabus of training of forensic odontology.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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