

Original Research Paper

Digital Analysis of Lip Prints for Personal Identification: A Cross Sectional Study in South Indian Population

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Abstract

Personal identification plays a pivotal role in identifying unknown persons both dead and alive. Cheiloscopy deals with examination of system of furrows on the red part of human lips. The present study was undertaken to classify lip prints, study their variations, determine the most common pattern in the study population, and evaluate differences in lip prints between males and females. Lip prints of 150 individuals, were obtained using lipstick and adhesive tape. The lip prints were scanned and analysed using Adobe® Photoshop® software 7 and classified according to Tsuchihashi classification. All the lip prints showed different patterns. Patterns of lip prints occurred in various combinations. The patterns were similar between males and females. Type II was the most common followed by Type I. Although Lip prints have been found frequently at crime scenes its use is still in the budding stage. It is suggested to institute a record of lip prints for all individuals in a certain locality, hoping to be a reference in civil litigations and criminal cases.

KeyWords: Cheiloscopy, Personal identification, Lip prints, Forensic odontology, Digital analysis

Introduction:

Personal identification plays a pivotal role in identifying unknown persons both dead and alive. They are used in cases of execution, suicide, calamities, missing person inquiries and criminal investigation. [1] Dental, fingerprint and DNA comparisons are the most common techniques used. From the perspective of Forensic odontology various tools used are bite marks; lip prints and teeth in crime scenes. [2]

The finger print patterns are typical and permanent and hence considered as a tool for identification. Due to the new trends in crime detection techniques, the criminals are taking sufficient precautions like the use of gloves.

In such circumstances, the identification of criminals using fingerprint analysis fails to establish a positive identity. Thus investigators can rely on adjuvant technique such as cheiloscopy as supportive evidence. Lip prints are considered unique to an individual and analogous to fingerprints. [3]

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Lip prints are the normal lines and furrows in the form of wrinkles and grooves present in the zone of transition of the human lip between the inner labial mucosa and outer skin. [4] Cheiloscopy is a Forensic investigation procedure that deals with identification of humans based on lip traces. [5, 6]

Lip prints were first noted in 1902 by an eminent anthropologist, R. Fischer. It was only in 1932, a French person named Edmond Locard advocated the use of lip prints in personal identification and criminalization. [7] In 1950 Synder was the first person who suggested the idea of using lip print for identification. [8]

In the period from 1968-1971 based upon the research of two Japanese scientists, Y. Tsuchihashi and T. Suzuki it was established that the arrangement of lines on the red part of human lips is individual and unique for each human being. [3, 9]

The significance of Cheiloscopy in personal identification is due to the evidence that, once developed at the 6th month of intrauterine life they are permanent, unchangeable even after death, and unique to each person except in monozygotic twins. [4, 5, 7-10] Lip prints are now considered as important tools of personal identification in crime scenes such as murders, rape and burglaries.

No such study has been carried out in this region of South India. The present study was therefore, undertaken to enlighten on the distinctiveness of the lip prints, to analyse the various lip patterns in different quadrants of the

lip and thereby determine the most common lip patterns and its role in gender identification in the population of Coimbatore.

Material and Methods:

Patients and students reporting to the Dental outpatient department over a period of one month were selected for the study after obtaining informed consent. The approval from the ethical committee of the institution was obtained regarding the study. The study group comprised of 150 patients segregated into 2 groups, (75 males and 75 females) aged between 18 to 70 years.

The study sample included residents of Coimbatore with atleast 2 generations residing here. Lips free of any pathology were included in the study. Patients with conditions like inflammation, trauma, congenital deformity, orthodontic treatment disease or deformity of the lips and hypersensitivity to the lipstick were excluded from the study.

The armamentarium comprised of: Betadine solution, Lakme lip liner, herbal hand cleanser, lipstick applicator brush, Lipstick of a dark, bright colour and non-glossy (Lakme), Scotch Magic™ tape, cellophane tape, White bond paper, scanner and software Adobe Photoshop 7 USA.

The lips of the subjects were first cleaned carefully with betadine solution. The outlines of the lips were marked with a sharp lip liner pencil (Lakme). The tip of the lip liner was later cleansed with a cotton ball dipped in an herbal hand cleanser, (Himalayas) prior to using it on the next person.

Lipstick was applied uniformly to the lips using lipstick applicator brush starting at the midline and moving laterally.

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. The subjects were advised to avoid movement during the procedure.

These prints were stuck onto white paper in a manner similar to that described by Sivapathasundharam et al. [5] For each patient a new lipstick applicator brush was used.

The lip prints of each individual were scanned using an image scanner set at a resolution of (256 grey shades at a resolution of 300 dpi. They were stored as JPEG (Joint Photographic Experts Group) files for maximum details. The most legible prints of both lips taken

together on cellophane tape were cropped and divided into four quadrants.

The lip prints obtained were coded, while noting the name and sex of the respective individuals. At the time of analysis the sex of the print was not disclosed.

Each lip was divided into two quadrants starting from right upper to right lower quadrant [Q1-Q4] using Adobe® Photoshop® 7.0 software. (Fig. 1,2)

The lines and furrows present, their length, branching and combinations were analysed quadrant-wise, denoting the type according to Suzuki's classification, (Fig. 3-6) which is as follows: [2,8]

- **Type I:** Vertical, comprising of complete longitudinal fissures.
- **Type I':** Incomplete longitudinal fissures.
- **Type II:** Branching 'Y' shaped pattern.
- **Type III:** Criss-cross pattern.
- **Type IV:** Reticular, typical chequered pattern, fence like.
- **Type V:** All other patterns.

Each Lip print was compared with other to test the uniqueness of lip prints. Analysis was done by studying the number and position of different patterns in all four quadrants.

Results:

A comprehensive assessment of each lip print revealed its individuality and that each print is distinctive.

All the lip prints showed different patterns. Type II pattern was found to be common among upper and lower lip in both males and females followed by type I. (Table 1 Graph1) Analysis of lip prints in each quadrant was done. Among males type II pattern was most common in quadrants 1-4 having 42%, 55%, 45% and 48% respectively.

This was followed by type I pattern Q 1-4 36%,25%,39% and 30% respectively. Among females type II pattern was most common in quadrants 1-4 having 49%, 42%, 45% and 47% respectively. The least common pattern is reticular pattern type IV 2.85% in males 9% in females. (Table 2 Graph 2)

In the upper lip type I and II patterns are common and in lower lip type III and IV are common. About 85% of the patients have different lip patterns in all the quadrants and 15% of patients have similar lip patterns. (Table 3 Graph3) 10 impressions were spoilt and were not included in the study.

Discussion:

The present study is the first cheilosopic study describing the lip-print patterns in the population of Coimbatore males

and females. This study was carried out to scrutinise the diverse patterns of lip prints and determine its role in personal identification. The utilisation of lip prints in personal identification in criminal investigations is still in its infancy.

Although very few studies are available on lip prints, a landmark study performed by Suzuki et al and Tsuchihashi [3, 9] gave a new dimension to the study of lip prints. They devised a standard classification which formed the foundation of many studies in the future.

In our study lip print patterns in all 150 subjects were distinct and none of the patterns were identical. This finding was in compliance with results obtained in the similar studies conducted earlier by Tsuchihashi and Suzuki [3, 9] and various other authors [10-15]

Lip print patterns did not simply comprise of one type alone, but appeared as a mixture of varying types. [9]

In this study we found that the most common pattern is the type II, Type III, Type IV and Type I in the descending order. The analysis of lip prints in different quadrants revealed the presence of Type II in all the quadrants followed by Type I. Type III and IV were equally distributed in all the quadrants. (Graph 2)

Type IV was the least common and was similar to the finding by Sivapathasundharam et al. [5] but our findings are in contrast to the study done by Annie Joseph Verghese et al on population of Karnataka. In their study most common type of lip print was Type IV, which is the reticular type of lip print. [16] Our findings are also non consistent with Bhuvan et al, in which type I pattern was the most prominent pattern among Indian and Malaysian males and females for the complete lip. [17]

All the four quadrants showed different patterns in 5% of males and 1% of females. Similar lip print patterns were observed in three quadrants in 20% of males and 21% of females. Similar lip print patterns were observed in two quadrants in 35% of males and 36% of females.

Similarities among all the four quadrants were noticed in 10% of males and 12% of females. (Graph 3) All the lip prints were unique and distinctive. In our study Type II is common in both males and females. Our results are in agreement with those of Rubio and Villalain who did not find significant differences in lip prints based on sex, age or race. [18]

Type III may not be commonest in both males and females as it was reported by others. [5, 8] It was also observed that no two persons had similar lip prints, either the same type or different types. It was further noticed that not

even a single person had one particular type of lip print in the upper lip or lower or in both.

Thus the statement of Tsuchihashi [8] is true and can be justified in stating that each of the subjects has his own or her own lip print.

Tsuchihashi Y [9] investigated Lip Prints of 1364 inhabitants of the Metropolitan and rural prefectures of Tokyo, Kanagawa, and Saitama in Japan and revealed that in both sexes Type III was commonest followed in order by Types I, II, IV and V. Sivapathasundharam B, Prakash P.A [5] studied 200 subjects at Chennai and recorded Type III pattern as the predominant one and Type IV as least commonly occurring.

Manipady S [12] studied Lip Prints of 100 subjects studying at Kasturba Medical College and International Centre for Health Sciences, Manipal, 50 each of Indian and Chinese origin, including male and female in the age group of 18-22 years, concludes by stating that the incidence of Type II pattern is the most commonest pattern seen in the studied subjects and that the pattern of distribution is not affected by race or sex.

Molano M.A et al [13] found among 168 dental students from the College of Dentistry of the University of Antioquia, that the Type III pattern (Suzuki Tsuchihashi), is the most common one among the population studied, this finding coincides with the results observed in previous studies done in subjects of a race different than the South American crossbred.

According to Vahanwala S.P., Parekh B.K [11] Type 1 and type 2 were common in the first and second quadrant. Reticular type was least common in 2, 3 and 4 quadrants in males. In first quadrant Type I' was the least common.

In females Type I' was least common in all the quadrants. Hirthet al [14] observed that branched pattern was more frequently present in the upper lip and simple pattern was commonly seen in the lower lip, which was in contrast with that seen in our study.

J. Augustine et al [15] in their study concluded that the most predominant pattern in the entire study population, taking both the upper and lower lips together, was type III (48.2%). This was followed in order by type II (18.92%), type IV (17.44%), type I (11.10%), type I' (2.54%) and type V (1.58%).

RV Prabhu et al [19] found the most predominant pattern to be Type V, Type I, Type II (Type IV (40 lines; 3.61%), Type III (9 lines; 0.81%). They recorded the following types of type V patterns for the first time; Trifurcations, Bridge or 'H' pattern, Horizontal Lines, Cartwheel, Pineapple Skin and Multiple

Branching appearance. No such patterns were found in the current study.

Ball [20] had reported the history of lip prints and importance of its evidence in the courts and the status of lip prints as a source of Forensic evidence. She had also stated that latent lip prints would be available at all crime scenes as the vermilion borders of lips have minor salivary glands and sebaceous glands with the latter being principally present around the edges of the lip associated with hair follicles, sweat glands in between and secreting oils.

It is these secretions and continual moisturizing by the tongue due to occasional sebaceous glands present on the lip to alveolar mucosa, crossing the transitional zone, there are chances for the presence of the latent lip prints on items such as glasses.

Lip prints at crime scenes are rarely mentioned simply due to the fact that, most investigators or crime scene examiners do not look for them. On the numerous occasions when a smear or a smudge is discovered, most crime scene personnel disregard it as being a fingerprint that is unidentifiable.

It is important to note, lip prints left at scenes of a crime are more prevalent than one thinks. Articles such as drinking glasses, letters, cigarette butts, clothing, napkins and even skin may possess lip prints that could eventually lead to the identity of a suspect, victim or a witness of a crime. The method described by Sivapathasundharam et al [5] was selected for this study for the accuracy of details achieved, the ease of obtaining such details and the protection and preservation provided by the adhesive tape to the impression once it was stuck onto the paper.

Two sets of lip prints were useful for confirmation of patterns in cases where details were diminished. The obtained lip prints were scanned. The scanned images could be preserved safely with loss of minimal details, divided into equal parts using the ruler in the software, adjusted for brightness and contrast and magnified as much as necessary for clear visualization of details.

These images could be filed systematically and stored as a database for further use as and when necessary.

According to this finding, it is suggested to institute a record of lip prints for all individuals in a certain locality, hoping to be a reference in civil litigations and criminal cases. This study proved the distinctiveness of lip prints in Coimbatore as no identically similar lip-print patterns appeared in two subjects. (Table 3)

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Table 1: Sex wise distribution of Lip print Patterns

Lip Print Patterns	Males	Females
Type I	32	14
Type I'	5	4
Type II	45	45
Type III	14	26
Type IV	3	9
Type V	0	0

Table 2: Frequency of Lip Print Patterns in Different Quadrants in Relation to Gender

	Q1		Q2		Q3		Q4	
	M	F	M	F	M	F	M	F
Type I	36	9	25	11	39	14	30	18
Type I'	6	4	4	4	4	0	4	1
Type II	42	49	55	42	45	45	48	27
Type III	13	24	15	31	13	27	16	22
Type IV	3	14	1	7	3	10	2	7
Type V	1	0	0	0	1	0	0	0

Table 3: Frequency of Repetition of Lip Print Patterns in Relation to Gender

Lip print repetition	Males	Females
All quadrants same	10	12
Three quadrants same	20	21
Two quadrants same	35	36
No quadrants same	5	1

Fig. 1: Lip Pattern Analysis on Adobe Photoshop Software

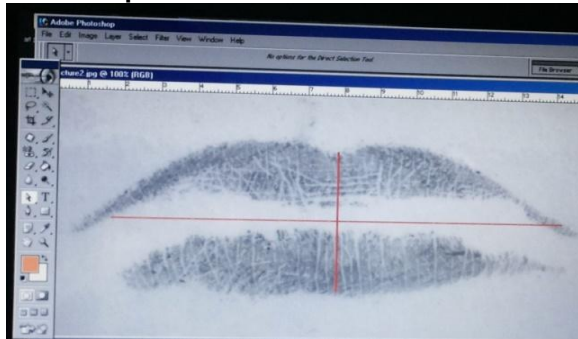


Fig. 2: Lip Print Patterns Classified by Suzuki et al

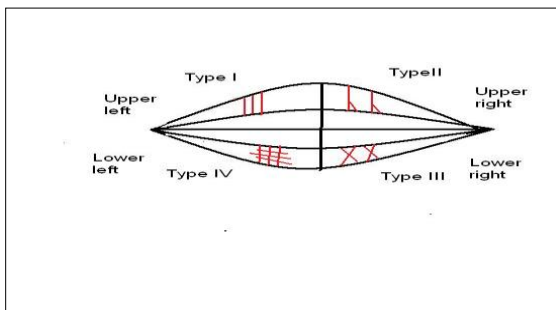


Fig. 3: Type I Lip Pattern

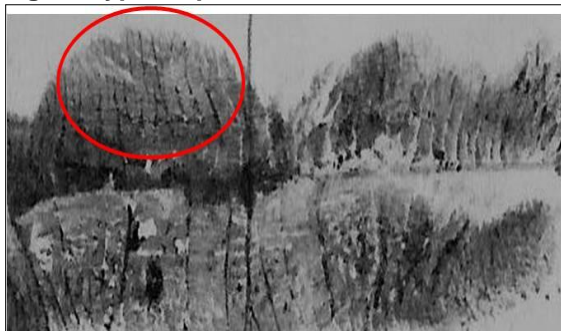


Fig. 4: Type II Lip Pattern

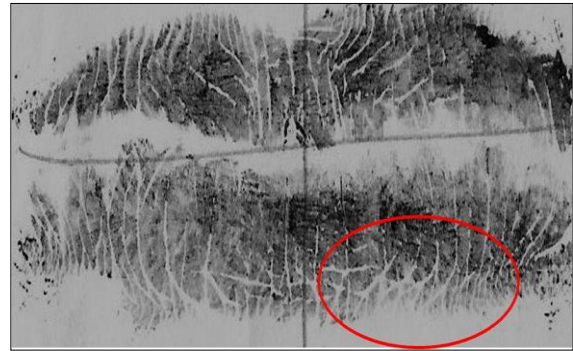


Fig. 5: Type III Lip Pattern



Fig. 6: Type IV Lip Pattern

