ORIGINAL ARTICLE

Study of lip prints

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Abstract

The external surface of lips has many elevations and depressions forming a characteristic pattern called lip prints, examination of which is known as cheiloscopy. The lip prints are unique and distinguishable for every individual like fingerprints. The use of lip prints for human identification was first suggested in 1950 and researches were carried out in 1960s and early 1970s, resuming in the last few years. The present study was aimed to study the lip prints of different individuals in different parts of the lip and find out the incidence of any particular pattern in the given age group. Although lip prints identification has been utilized in the court in isolated cases, more researches need to be conducted in this field with regards to confirmation of uniqueness, and the collection and interpretation of evidence.

Key words: Cheiloscopy, lip prints, sex determination

Introduction

Lip prints are normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of human lip, between the inner labial mucosa and outer skin, examination of which is known as cheiloscopy. This is unique for individuals, as finger prints. Research studies and information regarding the use of lip prints as evidence in personal identification and criminal investigation in dentistry, although age old, are scanty. However, studying in depth and establishing further facts and truth in lip prints will certainly help as useful evidence in forensic dentistry.

Historical overview

Fischer in 1902 was the first anthropologist to describe the furrows on the red part of the human lips.[1] However, it was only in 1932 that Edmond Locard, one of France's greatest criminologists, recommended the use of lip prints in personal identification and criminalization.[2] In 1950, Synder reported in his book *Homicide Investigation* that the characteristics of the lips formed by lip grooves are as individually distinctive as the ridge characteristics of finger prints.[3] Suzuki, in 1967, made detailed investigations of the measurement of the lips, the use and color of rouge, and the method for its extraction to obtain useful data for practical forensic application.[4] Later in 1970, Suzuki and Tsuchihashi, conducted a study on 107 Japanese families and named the grooves on labiorum rurorum as sulci labiorum and the lip prints consisting of these grooves as '*Figura linearum labiorum rubrorum*'.[5] Mc Donell in 1972 conducted a study on lip prints between two identical twins and reported that two identical twins seemed to be indistinguishable by every other means but their lip prints were different.[2]

Cottone, in 1981, reported in his book *Outline of Forensic Dentistry*, that cheiloscopy is one of the special techniques used for personal identification.[6] In 1990, Kasprzak conducted a research for period of five years on 1500 persons to elaborate the practical use of cheiloscopy.[1] Recently, Vahanwala in 2000 conducted a study of lip patterns to promote the importance of cheiloscopy in forensic science identification.[7]

Classification schemes

In 1967, Santos[8] was the first person to classify lip grooves. He divided them into four types namely:

1. Straight line
2. Curved line
3. Angled line
4. Sine-shaped curve

Suzuki and Tsuchihashi,[5] in 1970, devised a classification method of lip prints, which is as follows:

1. Type I – A clear-cut groove running vertically across the lip.
2. Type II – Partial-length groove of Type I.
3. Type III – A branched groove.
4. Type IV – An intersected groove.
5. Type V – A reticular pattern.
6. Type VI – Other patterns.

The present study was aimed to study the lip prints of different individuals in different parts of the lip and find out the incidence of any particular pattern in the given age group in relation to specific gender.

Materials and Methods

Study sample

A sample of 100 individuals comprising 50 males and 50 females were included in the study. All individuals were aged between 18 and 30 years. Lips free from any pathology, having absolutely normal transition zone between the mucosa and skin were included in the study. Consent of all the individuals was obtained for the study.

Study materials

In order to classify the lip prints in this study, the classification scheme proposed by Suzuki and Tsuchihashi[5] was used [Figure 1]. Materials used were:

1. Brown and red colored lipstick
2. Cellophane tape
3. White chart paper
4. Magnifying lens

Technique

The lips of the individuals were cleaned and the brown-colored lipstick was applied on the lips. Over the lipstick, the glued portion of cellophane tape strip was placed and the subject was asked to make a lip impression in the normal rest position of the lips by dabbing it in the center first and then pressing it uniformly toward the corners of the lips. The cellophane strip was then stuck to the white chart paper for permanent record purpose and then visualized by magnifying lens. While studying the various types of lip prints, each individual's lips were divided into four compartments, i.e., two compartments on each lip, and were allotted the digits 1–4 in a clock-wise sequence starting from the subject's upper right.

Results

A total of 100 individuals were included in the study, comprising of 50 males and females each, in the age group of 18–30 years. In overall study, no individual had single type of lip print in all the four compartments and no two or more individuals had similar type of lip print pattern [Figure 2].

When the overall pattern was evaluated among all the lip compartments of the study subjects, it was found that intersecting pattern was most common, both among males and females having 39.5 and 36.5%, respectively. However, the least common was the reticular pattern seen in 11.0% males and 13.0% females [Table 1].

The intersecting pattern was found to be most common among upper and lower lips of both males and females. The analysis of lip print type in each compartment was done. Among males, it was found that intersected pattern was most common in compartments 1–4 having 34, 32, 50, and 42%, respectively, while the least common pattern in lip compartments 1, 2, and 4 was the reticular pattern having 6, 10, and 12%, respectively. However, in compartment 3, males showed branched pattern as the least common (4%). On evaluation of the lip prints of the females, compartments 1, 2, and 3 exhibited intersected pattern predominantly having 38, 48, and 38%, respectively. However, in compartment 4, branched pattern was commonest (24%). Lip compartments 1, 3, and 4 of the females showed the reticular pattern as the least common having 8, 10, and 20%, respectively, while compartment 2 had vertical lip prints

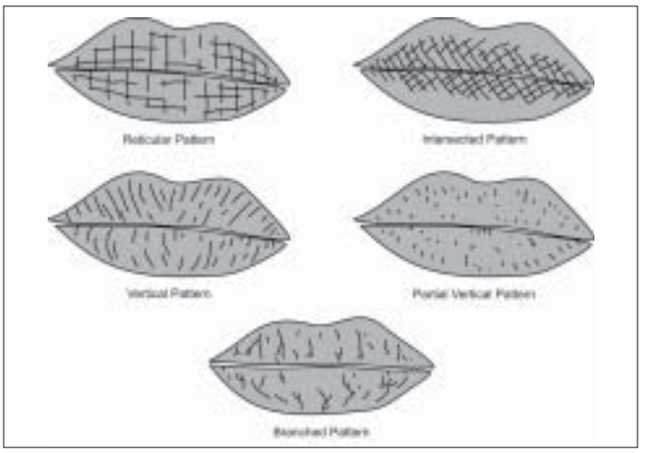

Figure 1: Various lip print patterns

Figure 2: Lip print patterns demonstrating inter-individual variation

Table 1: Lip print patterns in males and females

Lip print pattern (%)	Males (N=50x4)	Females (N=50x4)
Vertical	25 (12.5)	37 (18.5)
Branched	28 (14.0)	45 (22.5)
Intersected	79 (39.5)	73 (36.5)
Reticular	22 (11.0)	26 (13.0)
Undetermined	11 (5.5)	13 (6.5)
Poor quality	35 (17.5)	6 (3.0)

least in number (10%) [Table 2].

Few impressions which were of poor quality were not included in the study. Ten point two five percent of all the lip prints obtained in the study were spoiled, the maximum being in the first and the second lip compartments of the males (5.75%) [Table 2].

Discussion

Personal identification is necessary for unknown deceased person in homicide, suicide, accident, mass disaster, etc. and for living individual who are missing or culprits hiding their identity. Usually the personal identification is made by comparing the antimortem record with that of the postmortem record. If a definite description of the different parts of the upper lip and lower lip are established for an individual by detailed study, this antimortem record can be used for matching the details of lip prints in postmortem records for personal identification.

Research studies and information regarding the use of lip prints as evidence in personal identification and criminal investigation in forensic dentistry is very much scanty. In spite of few studies available, the study of Tsuchihashi gives a standard classification of his own for different types of lip prints.[5] Keeping this classification as the basis, the current study was conducted to study the lip prints of different individuals in different parts of the lips, to establish facts so as to aid in giving further details of lip prints.

Suzuki *et al.*, conducted a study and concluded that lip prints are dissimilar among different individuals.[9] This is in accordance with the results of present study. In our study, it was found that both among males and females the most common lip print pattern was the intersected type while the least common was the reticular pattern. These findings coincide with those by Sivapathasundaram *et al*.[10]

The analysis of lip print among different compartments of the males led to the observation that intersected pattern was predominant in all the four compartments, while in compartments 1, 2, and 4 reticular pattern was the least. Compartment 3 of males showed branched pattern the minimum. Similarly, the most common pattern among the females in compartments 1, 2, and 3 was the intersected and in 4 was the branched pattern. However, females exhibited

Table 2: Lip print patterns in each lip compartment of males and females

Lip compartment	Lip print pattern(%)	Males (N=50x4)	Females (N=50x4)
1	Vertical	7 (14.0)	11 (22.0)
	Branched	8 (16.0)	10 (20.0)
	Intersected	17 (34.0)	19 (38.0)
	Reticular	3 (6.0)	4 (8.0)
	Undetermined	2 (4.0)	3 (6.0)
	Poor quality	13 (26.0)	3 (6.0)
2	Vertical	7 (14.0)	5 (10.0)
	Branched	10 (20.0)	11 (22.0)
	Intersected	16 (32.0)	24 (48.0)
	Reticular	5 (10.0)	7 (14.0)
	Undetermined	2 (4.0)	1 (2.0)
	Poor quality	10 (20.0)	2 (4.0)
3	Vertical	3 (6.0)	10 (20.0)
	Branched	2 (4.0)	12 (24.0)
	Intersected	25 (50.0)	19 (38.0)
	Reticular	8 (16.0)	5 (10.0)
	Undetermined	3 (6.0)	4 (8.0)
	Poor quality	9 (18.0)	0
4	Vertical	8 (16.0)	11 (22.0)
	Branched	8 (16.0)	12 (24.0)
	Intersected	21 (42.0)	11 (22.0)
	Reticular	6 (12.0)	10 (20.0)
	Undetermined	4 (8.0)	5 (10.0)
	Poor quality	3 (6.0)	1 (2.0)

the reticular pattern to be least in compartments 1, 3, and 4, while compartment 2 had vertical lip prints least in number. These results of our study do not coincide with that by Vahanwala and Parekh who showed the Y -pattern dominant in females in third and fourth quadrants and end-to-end pattern common among males in second quadrant.[7]

One common problem that is encountered during the cheiloscopic studies is that of smudging or spoiling of lip prints leading to unidentifiable marks.[10] In our study, 10.25% of all the lip prints were spoiled, the maximum being in the first and second compartments of the males (5.75%). The reason for this can be attributed to the presence of prominent facial hair among men.

To state the importance of cheiloscopy in forensic science identification, Ball 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 latter being principally present around 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, there are chances for the presence of the latent lip prints on items such as glass.[11] These lip prints can be obtained up to 30 days after being produced.[12]

Practical Applications

Suzuki and Tsuchihashi reported two cases where lip prints

have proven useful in identification of the criminal. In first case while the lip prints were identified on an envelope and with those of the suspects, the second case lip prints were noted on the undergarments and were studied with the help of color test and ultraviolet rays.[13] In 1987, FBI had successfully identified a male bank robber who used female disguises including lipstick. The FBI submitted the photographs and lifts of the lip prints that robber had left on the glass door while robbing a bank, which were identified to match with that of suspected robber. These cases suggest that lip print study can definitely be used for criminal identification.[14]

In an investigation, Aggarwal has proved beyond doubt that lip prints are as good as finger prints in criminal identification and can be definitely used when no other means of traditional methods of identification are available.[2] However, as far as the legal matters in Indian judicial system are concerned, this technique needs to be used more frequently in routine civil and criminal litigations.

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