■ *Original Article*

Lip print pattern: an identification tool

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Abstract

Background: Cheiloscopy is a forensic investigation technique that deals with the identification based on lip traces. Based upon the research, it was established that the arrangement of lines on the red part of human lips is unique for each human being. **Objectives:** To analyze and compare quadrant wise and sex wise predilection of lip print pattern. **Methods:** A total of 200 (18-25 years) Nepalese undergraduate students of BPKIHS were selected. Thin layer of lip-stick was applied on the lips of these sub-jects. The hinged por-tion of a folded paper was inserted between the lips and the sub-jects were asked to press their lips onto it. Only middle 10 mm of both upper and lower lips were taken as study area. The lip prints, thus obtained were stud-ied on the basis of Tsuchihashi's classification. Chi square test was used to analyze and compare the lip print patterns in all the quadrants of males and females, with the level of significance $p<0.05$. **Results:** Type I pattern was predominant in all the four quadrants among males (62%, 56%, 54%, 57% in first, second, third and fourth quadrants respectively). In female also type I was predominant in 2nd, 3rd and 4th quadrant (40%, 45%, 51% respectively) whereas in 1st(right upper) quadrant type II pattern was predominant (37%). **Conclusion:** Lip print pattern can be used as an additional tool for personal identification and sex determination. Further work on the subject can help to make cheiloscopy a practical reality in the forensic identification process.

Keywords: Cheiloscopy, Lip prints, Forensic identification

Introduction

Personal identification is becoming increasingly important not only in legal medicine but also in criminal investigation, identification and Genetic Research.[1] A wide range of methods are available for this purpose out of which, the best and most often used is fingerprints. An alternative method of identification is cheiloscopy, which is the study of the grooves and furrows present on the red part of the human lips. These

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grooves occur as distinct patterns or types and are unique to each individual and thus can be used to fix the identity of a person.[2]

This biological phenomenon was first noted by anthropologists. R. Fischer was the first to describe it in 1902. Lip prints are unique as finger prints and do not change during the life of a person.[3] It has been verified that they recover after undergoing alterations like trauma, inflammation and diseases like herpes and that the disposition and form of the furrows does not vary with environmental factors. The lip prints of parents and children and those of siblings have shown

some similarities.[4] 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.[5] It has also been suggested that variations in patterns among males and females could help in sex determination.[4]

In 1967, Santos was the first person to classify lip grooves. He divided them into four types namely: [4]

   1. Straight line

   2. Curved line

   3. Angled line

   4. Sine-shaped curve

Suzuki and Tsuchihashi, in 1970, devised a classification method of lip prints, which is as follows: [6]

Type I   - A clear-cut groove running vertically across the lip

Type I' - Partial-length groove of Type I

Type II - A branched groove

Type III - An intersected groove

Type IV - A reticular pattern

Type V - Other patterns

These are most widely used classification in literature. Research suggests the conclusive evidence that lip prints are suitable for the successful comparison, analysis and identification of a person to crime.[7] This type of study hasn't been conducted among Nepalese population. So, the purpose of this study was to document common lip patterns among Nepalese population under investigation and to assess the quadrant wise and gender wise predilection of lip print patterns.

Methods

This study was conducted among 200 students of BPKIHS (100 males and 100 females) aged 18-25 years, who were willing to participate. Ethical clearance was obtained from the institutional Ethical Committee BP Koirala Institute of health Sciences, Dharan, Nepal. Consent was taken from all the participants. Students whose lips were free from pathology and had normal transition zone between the mucosa and skin were included, whereas Students having Gross deformities of lips (cleft lip, ulcers, traumatic injuries on lips) and were allergic to the lip stick were excluded. In order to classify the lip prints, the classification scheme proposed by Suzuki and Tsuchihashi was used. The lips were cleaned and a thin layer of red/brown col-ored lip-stick was applied on the lips. A sheet of bond paper was folded and the "hinged" por-tion of the paper was

inserted in between the lips and sub-jects were asked to press their lips onto it. It was then "unfolded" again. Employing the dental formula generally used, the lip was divided into four quadrants. A vertical line was drawn with a pencil at the centre of the print. At a distance of 5mm on either side of this line parallel line was drawn to the first line. These lines demarcated the middle 10mm of the both upper and lower lip which was the area to be studied, as only these areas are commonly found at crime scenes. The lip prints in each quadrant was stud-ied using a magnifying lens.

Statistical analysis

All the data were entered in Microsoft excel and analyzed using SPSS package (version 12). All the data were presented as frequency and percentages. Chi square test was used to analyze and compare the lip print patterns. The level of significance was $P<0.05$.

Results

The present study was conducted to access the quadrant wise and gender wise predilection of Lip print patterns. Lip print impressions were obtained from both males and females and were classified by Suzuki's classification. The distribution of lip print types in males and females in each quadrant were compared. Table 1 depicts the overall results of the present study. The distribution of various types of lip prints in all the four quadrants of both males and females have been summarized (Figure 1-5).

Figure 1: Tsuchihashi's Type I Lip Print Pattern: Clear

cut vertical grooves running across entire lip.

Figure 2: Tsuchihashi's Type I' Lip Print Pattern- Similar to Type I but doesnot cover entire lip

Figure 3: Tsuchihashi's Type II: Branched groove

Figure 4: Tsuchihashi's Type IV: Reticular grooves

Figure 5: Type V Lip Print Pattern- Grooves that cannot be morphologically differentiated

Table 1: Frequency of lip print patterns among males and females

Type	Sex	RUQ	LUQ	LLQ	RLQ
Type I	Males	62	56	54	57
	Females	32	40	45	51
Type I'	Males	8	12	10	8
	Females	14	16	19	15
Type II	Males	24	28	26	25
	Females	37	32	26	25
Type III	Males	0	0	6	6
	Females	5	2	0	3
Type IV	Males	4	3	2	1
	Females	12	10	9	6
Type V	Males	2	1	2	3
	Females	0	0	0	0
P Value		<0.000	>0.068	<0.007	>0.074

First Quadrant
Type I pattern was seen in 62% of males and 32% of females. Type I' pattern was observed in 8% of males and14% of females. Type II pattern was observed in 24% of males and 37% of females. Type III pattern was noted in 5% of females. This pattern did not occur among males in this quadrant. Type IV pattern was

seen in 4% of males and 12% of females. Type V pattern was seen in 2% of males and was not seen among females. The distribution of the Lip print types was seen to be statistically significant with P< 0.00.

Second quadrant
Type I pattern was seen in 56% of males, compared to 40% of females. Type I' pattern was observed in 12% of males and 16% of females. Type II pattern was observed in 28% of males and 32% of females. Type III pattern was noted in 2% of females. This pattern did not occur among males in this quadrant. Type IV pattern was seen in 3% of males and 10% of females. Type V pattern was seen 1% of males but was not seen among females. The distribution of the Lip print types was not statistically significant p> 0.68.

Third quadrant
Type I pattern was seen in 54% of males, compared to 45% of females. Type I' pattern was observed in10% of males and 19% of females. Type II pattern was observed in 26% of males and 26% of females. Type III pattern did not occur in females but was seen in 6% of males in this quadrant. Type IV pattern was seen in 2% of males and 9% of females. Type V pattern was seen in 2% of males and was not seen among females. The distribution of the Lip print types was seen to be statistically significant p< 0.007.

Fourth quadrant
Type I pattern was seen in 57% of males, compared to 51% of females. Type I' pattern was observed in 8% of males and 15% of females. Type II pattern was observed in 25% of males and 25% of females. Type III pattern was observed in 6% of males and 3% of females. Type IV pattern was seen in 1% of males and 6% of females. Type V pattern was seen in 3% of males and was not seen among females. The distribution of the Lip print types was not statistically significant p>0.74.

Discussion
Crimes challenge the society in detection, diagnosis and identification of criminals. Establishing a person's identity can be a very difficult process. Dental, fingerprint and DNA comparisons are probably the most common techniques used. One of the most interesting methods of human identification is human lips recognition. Lip prints can be obtained at the crime scene from clothing, cups, glasses, cigarettes, windows and doors.[7] In the present study Type I lip print pattern

was common in all the quadrant of males and females except right upper quadrant in female where Type II pattern was predominant. Amith V in their study found Type I' to be the most predominant pattern in first and second quadrant, Type II in third and fourth quadrant among males and females, Type I pattern was predominant in all the quadrants.[8] Manypady compared Indian and Chinese individuals and found that the incidence of Type II pattern was highest among Indians.[2] In our studied Nepalese population, we found Type I as the most predominant pattern in all the four quadrants followed by Type II, Type I', Type IV, Type III and Type V. Annie J et al in their study among people of Kerala found Type IV (reticular) pattern to be the most predominant pattern in the middle portion of upper lip.[3] Tsuchihashi Y et found type III pattern as the most predominant pattern in their study population (31.3% males and 33.3% females) followed by Type I, Type II, Type IV then Type V pattern.[9] In our study Type III pattern was not seen among males in upper quadrants, whereas it was seen in only 6% of male in lower quadrant. Among females, Type III pattern was seen in all the quadrants except left lower quadrant. TR Saraswathi in their study 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.[5] Vahanwalla and Parekh in Mumbai found type I pattern in lower lip of female, similar to our study.[10] In our study, Type V pattern was not seen among any females studied. This was in contrast to study done by Rachana V Prabhu, among Goan population, where Type V pattern was most predominant pattern.[11] Sivapathasundharam et al studied the lip prints of Indo-Dravidian population and noted that Type III pattern was predominant.[12] Our finding was not similar to any other studies. Various studies have shown that the lip print patterns formed revealed a population wise dominance that is a particular population is showing predominance of a particular lip print type. This is potentially useful tool for identification.

One common problem that is encountered during the cheiloscopy study is that of smudging or spoiling of lip prints leading to unidentifiable marks.[12] But in our study, none of the impression was spoiled. The use of lip prints is not limited to visible traces left at a scene of crime. Latent or invisible prints can be developed or made visible in a manner similar to that used for fingerprints. 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.[13] Lip prints can be obtained up to 30 days after being produced.[14]

Conclusion

Lip print shows population wise predominance. It can be used as an additional tool for identification and sex determination. Research studies and information regarding the use of lip prints as evidence in personal identification and criminal investigation in forensic dentistry are very scanty. Studying in depth and establishing further facts and truth in lip prints will certainly help as useful evidence in forensic dentistry.

Acknowledgement

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