Study of Lip Prints in Different Ethno-racial Groups in India

Abstract

Context (Background): Lips prints are unique and are a tool for personal identification. Aims: Indian population can be divided into different ethno-racial groups. In this study, we aimed at finding the most and the least prevalent lip print patterns in these groups and also to observe any similarities or differences that may exist in these groups in terms of lip print patterns. Settings and Design: Lip prints in 755 individuals categorized into different ethno-racial groups were studied. Materials and Methods: Brown- and pink-colored lipsticks, cellophane tape, and magnifying lens were used to record and study the lip prints. Results: Among all the three ethno-racial groups, Type I was the most prevalent lip print pattern observed. The least prevalent lip print pattern in all the three groups was Type IV. Inference/Conclusion: Lip prints hold potential as supplementary tools for identification where they can be recorded with ease. The observation and classification of lip print patterns in different ethno-racial groups not only provide some useful data but also open a new window to a field that can contribute extensively to criminal investigation and identification.

Keywords: Cheiloscopy, ethno-racial groups, lip prints, personal identification

The study of lip prints or cheiloscopy (from the Greek words, Cheilos = lips, Skopein = see) which is an integral part of forensic odontology is the forensic investigation technique that deals with the identification of humans based on lip traces.[1] Suzuki and Tsuchihashi named the wrinkles and grooves present of the lip which form the characteristic lip print patterns as “sulci labiorum rubrorum.”[2] The lip prints are unique and can be identified as early as the 6th week of intrauterine life.[3,4] Lip prints were for the first time described by Fisher in 1902.[4,5]

India is a vast country with 29 states, inhabited by diverse populations of tribes, castes, religions, and migrant groups. Although they share similar physical features, they show differences in cultural, anthropologic, and genetic traits.[6] Based on phylogenetic tree, Indians are closer to mongoloids than to Caucasoids or Negroids.[7] However, according to Indian genome variation database (IGVdb) 2005, modern anthropologists classify Indians as belonging to one of four major ethno-racial groups – Caucasoids, Australoids, Mongoloids, and Negritos. The Caucasoids are found in North, Central, and South Western regions of India. Australoids are found in the South whereas the Mongoloids are largely confined to the North-Eastern region of the country. Negritos are found on the Andaman Islands on the Southern Eastern side of the country.[9]

The aim of this study was to study the most prevalent lip print pattern in different ethno-racial groups of India, namely, Caucasoids, Australoids, Mongoloids, and Negritos. We also tried to see if there are any differences or similarities in the incidence of any particular pattern of lip print.

Although many studies on lip prints in Indian population have been conducted in the past, those comparing lip prints in different ethno-racial groups are very few. To the best of our knowledge, this is the first study, in which lip prints of different ethno-racial groups are studied extensively.

Materials and Methods

Ethical clearance for conducting this study was obtained from the Ethical Committee of Vydhee College of Dental Sciences and Research Center.

The study sample consisted of 755 subjects of Indian origin (375 males and 380 females) aged between 1 year and 80 years and they were divided into four

How to cite this article: Kaul R, Shilpa PS, Padmashree S, Bhat S, Sultana N. Study of lip prints in different ethno-racial groups in India. Indian J Dent Res 2017;28:545-8.
ethno-racial groups: Caucasoids, Australoids, Mongoloids, and Negritos.

The individuals belonging to different Indian states were divided into these ethno-racial groups as Caucasoids (Jammu and Kashmir, Uttar Pradesh, Uttarakhand, Delhi, Punjab, Haryana, Madhya Pradesh, Chhattisgarh, West Bengal, Bihar, Jharkhand, Orissa, Maharashtra, Goa, Gujarat, and Rajasthan), Australoids (Andhra Pradesh, Karnataka, Tamil Nadu, and Kerala), Mongoloids (Meghalaya, Arunachal Pradesh, Mizoram, Nagaland, Assam, Manipur, Tripura, and Sikkim), and Negritos (Andaman Islands). Classifying individuals into different ethno-racial groups based on the state of origin may be rudimentary, since there are many variations and diversities within these states based on caste, tribal, and religious groups. However, when grouping the subjects into different ethno-racial groups, their pedigree and place of origin was kept in mind based on the IGVdb 2005.\[8\]

In our study sample, 413 were Caucasoids, 307 were Australoids, and 35 were Mongoloids. There were no individuals belonging to Negritos group [Figure 1].

Inclusion criteria

Individuals aged above 1 year with lips free from any pathology and having absolutely normal transition zone between the mucosa and skin were included in the study after obtaining informed consent.

Exclusion criteria

individuals with known allergy to lipstick, inflammation of lips, trauma, malformation, deformity, surgical scars, facial palsy, and active lesions of the lips were excluded from the study.

Study material/armamentarium

Study material/armamentarium comprised [Figure 2]:
- Brown- and pink-colored lipstick
- Lipstick applicator
- Cellophane tape (2 × 5 inch wide)
- Executive bond paper
- Magnifying lens
- Lipstick remover liquid
- Cotton balls
- Scissors.

Procedure for recording lip prints

After obtaining the consent, the lips of the individuals who were already wearing lipstick were cleaned with a cotton ball dipped in lipstick remover. Lipstick was applied with a lipstick applicator evenly starting from center and moving laterally in a single motion. The individuals were asked to retain a relaxed position of their lips. After two minutes, once the lipstick had dried, the glued portion of the cellophane tape strip was placed, and the individual 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 executive bond paper for permanent record purpose and then visualized by magnifying lens [Figure 2]. The lip prints were coded based on the name and the sex of the individuals. To avoid bias, all the lip prints were compiled, analyzed, and interpreted only once by a single researcher well versed with the classification of lip prints.

Determination of lip print pattern

To determine the lip print pattern, each individual’s lips were divided into four compartments, i.e., two compartments on each lip. Classification system by Tsuchihashi[4] was used.

The statistical software, namely, SAS 9.2 and R environment version 2.11.1 were used for the analysis of the data and Microsoft Word and Excel were used to generate graphs, tables, etc. To find the intrarater reliability, a kappa test was done, and an asymptomatic standard error of 0.007 was found indicating high intrarater reliability.

Results

The most predominant lip print pattern in the entire study population was Type I (36.5%) [Table 1].
Among all the three ethno-racial groups, Type I was the most prevalent lip print pattern observed (38.01% in Caucasoids, 35.5% in Australoids, and 34.29% in Mongoloids). Type II lip print was the second most prevalent pattern in all the three groups (20.82% in Caucasoids, 24.75% in Australoids, and 22.8% in Mongoloids). The third most prevalent lip print pattern in Caucasoids and Australoids was Type III (18.15% and 15.96% in Caucasoids and Australoids, respectively), whereas in Mongoloids Type I’ was the third most prevalent lip print pattern (11.4%). The least prevalent lip print pattern in all the three groups was Type IV (0.04% in Caucasoids, 5.21% in Australoids, and 0.02% in Mongoloids) [Table 2].

Exceptions to this were Mongoloid females whereas both Type IV and Type V were the least prevalent [Table 2]. Another exception was mongoloid males where Type I’ was the most prevalent lip print pattern. In this group, both Type IV and Type II were the least prevalent lip print patterns [Table 2].

Discussion

Identification of unknown individuals has been of importance to the society from ancient times. Cheiloscopy, a genuine subspecialty of forensic odontology, is analogous to fingerprint analysis. Lip prints are very useful in forensic investigations and personal identification. Potential places where lip prints may be found and used in investigation of a crime are on tape that has been used to gag or bind a person, on a glass used to drink from, cigarette butt, or window glasses against which they have been pressed. Sometimes, lip prints may be seen as lipstick smears.

In cheiloscopy, one should also analyze lip anatomy, considering their thickness and position. The lips can be horizontal, elevated, or depressed in position. According to their thickness, lips can be of four types: thin lips (common in European Caucasian), medium lips (from 8 to 10 mm, most common type), thick or very thick lips (usually with an inversion of the lip cord, commonly seen in African-Americans), and mix lips (usually seen in East Asian).[5]

The present study was carried out to determine the prevalence of lip print patterns in different ethno-racial groups in India. We also tried to see if there are any differences or similarities in the incidence of any particular pattern of lip print.

The lip prints were recorded with the lips in closed and relaxed position using classification system by Tsuchihashi.[4] The uniqueness of lip print patterns depends on the way the lip muscles are relaxed to produce a particular pattern.[9] Furthermore, in closed mouth position, lips exhibit well-defined grooves, whereas, in an open mouth position, the grooves are not well defined and hence difficult to interpret.[11] To study the lip prints, each individuals’ lips were divided into four compartments – two compartments on the lower lip and two on the upper lip following the method advocated by Vahanwala[12] and used by Saraswathi et al.[13] Each compartment was studied, and the overall type of groove pattern was recorded as the lip print.

In our study, the examination of lip print patterns revealed that no two lip prints matched with each other. The uniqueness of lip prints was confirmed yet again by our study. This may be of great help in forensic field, where lip print can be used as a tool to identify the individual. It was observed that, in the entire study population, Type I lip print pattern was the most prevalent (36.5%). Furthermore, in both males and females, Type I remained the most prevalent type of lip print pattern (males 37.9% and females 35.5%). This finding is similar to the one obtained in a study comprising 600 individuals conducted by Vahanwala and Parekh[14] Randhawa et al.[15] and Sandhu et al.[16]

In our study, it was observed that Type I was the most prevalent and Type IV was the least prevalent lip print pattern in all the ethno-racial groups – Caucasoids, Australoids, and Mongoloids.

The high frequency of Type I lip print pattern in the present study contrasts with previous results – in a study conducted

---

Table 1: Distribution of predominant type of lip print pattern in the study population type of lip print

| Lip print pattern | Number of patients (%) |
|-------------------|------------------------|
| I                 | 277 (36.7)             |
| I’                | 62 (8.2)               |
| II                | 171 (22.6)             |
| III               | 131 (17.4)             |
| IV                | 34 (4.5)               |
| V                 | 80 (10.6)              |
| Total             | 755 (100.0)            |

Table 2: Distribution of predominant type of lip print pattern in different ethno-racial groups

| Type of lip print | Caucasoids (413) | Australoids (307) | Mongoloids (35) |
|-------------------|------------------|-------------------|-----------------|
|                   | Number of subjects (%) | FemaleMale| Number of subjects (%) | FemaleMale| Number of subjects (%) | FemaleMale|
| I                  | 157 (38.01) | 73 36 | 109 (35.50) | 54 103 | 12 (34.28) | 9 3 |
| I’                 | 37 (8.95)   | 17 4  | 21 (6.84)  | 14 23  | 4 (11.4)   | 4 4  |
| II                 | 86 (20.82)  | 52 24 | 76 (24.75) | 39 47  | 8 (22.8)   | 7 1  |
| III                | 75 (18.15)  | 32 17 | 49 (15.96) | 27 48  | 7 (20.2)   | 3 4  |
| IV                 | 17 (0.04)   | 13 3  | 16 (5.21)  | 4 13   | 1 (0.02)   | 1 1  |
| V                  | 41 (0.09)   | 18 18 | 36 (11.7)  | 16 25  | 3 (0.08)   | 1 2  |
by Prasad et al.\textsuperscript{17} on Aryan-Dravidian and Mongoloid groups, Type III was found to be most prevalent lip print pattern in both females and males. However, Type IV was the least prevalent lip print pattern in males, whereas, in females, Type I’ was the least prevalent lip print pattern. In another study on North Indian population, in females, Type I was the most prevalent and, in males, Type III was the most prevalent lip print pattern.\textsuperscript{15} These variations could be attributed to the geographic disparities that may exist in lip print with respect to the most common pattern.

**Conclusion**

Lip prints, because of their uniqueness, are valuable as evidence in criminal cases and also for personal identification. Lip prints are characteristic of an individual, and no two individuals have the same lip prints. There is a need to accept lip prints as legitimate means of identifying a person of interest. In a country like India with diverse population groups, more elaborate studies need to be conducted to understand the lip prints in different ethno-racial groups better.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Venkatesh R, David MP. Cheiloscopy: An aid for personal identification. J Forensic Dent Sci 2011;3:67-70.
2. Suzuki K, Tsuchihashi Y. New attempt of personal identification by means of lip print. J Indian Dent Assoc 1970;42:8-9.
3. Sivapathasundharam B, Prakash PA, Sivakumar G. Lip prints (cheiloscopy). Indian J Dent Res 2001;12:234-7.
4. Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci 1974;3:233-48.
5. Caldas IM, Magalhães T, Afonso A. Establishing identity using cheiloscopy and palatoscopy. Forensic Sci Int 2007;165:1-9.
6. Roychoudhury AK. Genetic relationships of the populations in Eastern India. Ann Hum Biol 1992;19:489-501.
7. Roychoudhury AK. Gene diversity in Indian populations. Hum Genet 1977;40:99-106.
8. Indian Genome Variation Consortium. The Indian Genome Variation database (IGVdb): A project overview. Hum Genet 2005;118:1-11.
9. Rothwell BR. Principles of dental identification. Dent Clin North Am 2001;45:253-70.
10. Acharya AB. Teaching forensic odontology: An opinion on its content and format. Eur J Dent Educ 2006;10:137-41.
11. Shailesh M, Gondvikar AJ, Degwekar S, Bhowate R. Cheiloscopy for sex determination. J Forensic Dent Sci 2009;1:56-60.
12. Vahanwala S. Study of lip prints as an aid for sex determination. Med Leg Update 2005;5:93-8.
13. Saraswathi TR, Gauri M, Ranganathan K. Study of lip prints. J Forensic Dent Sci 2009;1:28-31.
14. Vahanwala SP, Parekh BK. Study of lip prints as an aid to forensic methodology. J Forensic Med Toxicol 2000;17:12-8.
15. Randhawa K, Narang RS, Arora PC. Study of the effect of age changes on lip print pattern and its reliability in sex determination. J Forensic Odontostomatol 2011;29:45-51.
16. Sandhu SV, Bansal H, Monga P, Bhandari R. Study of lip print pattern in a Punjabi population. J Forensic Dent Sci 2012;4:24-8.
17. Prasad P; Vanishree. A comparison of lip prints between Aryans-Dravidians and Mongols. Indian J Dent Res 2011;22:664-8.