

A Cross-sectional Study of Lip Prints in Central India Population: Determination of Gender and Heritability Pattern

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Abstract

Background: Cheiloscopy is a quick, simple, reliable, and emerging forensic method for the identification of sex. Inheritance pattern has also been observed. **Aims:** The aim of the study was to determine the predominant pattern of lip prints in males and females belonging to Central India; to determine the existence of heredity pattern. **Materials and Methods:** Five hundred lip prints were collected from 200 males and 300 females. Twenty-five families, each family comprising of father, mother, and offspring were also examined. Y. Tsuchihashi's classification was used for determining the different types of prints in each sex and the families. The frequency of occurrence in percentage was calculated. **Results:** Chi-square test was used for intergroup comparison followed by Marascuilo for intragroup comparison. Type I was the most predominant pattern observed in the study population. In females, Type I ($P < 0.001$) was significantly observed whereas in males Type II, III, and IV ($P < 0.001$) was seen. The frequency of occurrence of Type I and I pattern in females (50% and 27%, respectively) was significantly higher ($P = 0.001, 0.001$, respectively) compared to their frequency in males (13% and 6%, respectively). 80.77% of offspring showed resemblance to either of their parent. The resemblance of females to their mother and that of males to their father was found to be significant ($P < 0.05$). **Conclusion:** In Central India population, Type I pattern of lip prints is common in females and Type II, III, and IV in males. The lip print patterns of females resemble more to their mothers and that of males to their fathers.

Keywords: Central India, Cheiloscopy, Forensic odontology, Heredity, Inheritance, Lip prints.

INTRODUCTION

Since ages, researchers have been working to trace back the line of evolution in a quest to know the origin of the human race. This has led to a very interesting issue of "Human identification." As our civilization is growing, the identification of people has become crucial in social, personal, and legal aspects. The advent of forensic odontology has opened new avenues for the researchers. The different methods employed in forensic dentistry include anthropology, rugoscopy, cheiloscopy, bite mark analysis, tooth prints, dental DNA analysis, and radiographs.^[1] The role and responsibility of a dental surgeon in personnel identification and criminal investigation is very much important as his evidence would be very much useful in law and justice.^[2]

Lip prints are the lines and fissures in the form of wrinkles and grooves, i.e., "sulci laborum" present in the transition zone of the human lip, examination of which is known as cheiloscopy. The facts that recruit lip prints in forensic sciences are that they are unique to an individual, do not change in the lifetime of

the person, and recover after undergoing minor alterations due to trauma, inflammation, etc.^[3] However, major alterations in these groove patterns due to trauma or any surgical treatment affecting the size and morphology of lips sets the biggest disadvantage in their utility.^[1] Variation in patterns between males and females aids in sex determination.^[4-6] Furthermore similarities in the lip prints of parents, children, and their siblings have been shown by some studies, suggesting a possible hereditary pattern of inheritance.^[7,8] Some investigators have also studied the association of heritable disease with a particular pattern of lip print, thus widening the scope of cheiloscopy.^[9]

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MATERIALS AND METHODS

A total of 500 randomly selected subjects of Indian origin belonging to various parts of Madhya Pradesh (Central India) were taken for the study. It consisted of 200 males and 300 females with ages ranging from 6 to 60 years. A total of 25 families were also examined. Each family included father, mother, and their offspring. Subjects were free of any lip pathology, deformity, congenital defect, surgical alteration, or allergy to lipstick. Ethical clearance from the institution and informed consent from the subjects were obtained. After cleaning and drying the lips, a dark-colored lipstick was applied uniformly from the center toward periphery in a single stroke up to the vermillion border. In physiologic rest position, the glued side of the cellophane strip was applied on the lips, first pressing in the center and then toward periphery so as to gain proper smudge-free prints. The cellophane strip was then stuck onto a bond paper for the preservation of the prints. Analysis of the lip print patterns was done with the help of a magnifying glass. The pattern present on the middle one-third part of the lower lip (ten mm wide) was examined.

The aims of the present study were to determine the predominant lip print pattern in a given sex and to determine the inheritance pattern in the Central Indian population.

The obtained lip print samples were classified according to Y. Tsuchihashi's classification.^[3] (Figure 1) the frequency of occurrence in percentage for each type of lip print pattern was tabulated and subjected to Chi-square test for intergroup comparison (within either sex group) followed by Marascuilo for intragroup comparison (between males and females). $P \leq 0.05$ was considered statistically significant.

RESULTS AND OBSERVATIONS

All the samples analyzed were different from each other validating the uniqueness of lip prints for an individual. Usually, a composite of two patterns especially Type I with Type I and Type II with Type III was seen, and the predominant pattern was taken into consideration.

Intragroup comparisons (Figure 2)

- In females, the most frequent pattern observed was Type I (50%), followed by type I' (27%), Type II (12%), Type III (5%), Type IV, and Type V (3% each) (Figure 1). The frequency of occurrence of Type I pattern in females was statistically significant ($P < 0.001$) when compared to other patterns in females.
- In males, Type II and Type III were the most frequent patterns with 27% frequency of occurrence, followed by Type IV (22%), Type I (13%), Type I' (6%), and Type V (5%). The occurrence of Type II, III, and IV patterns was statistically significant when compared to other patterns ($P < 0.001$).

Intergroup comparisons (Figure 2)

- The frequency of occurrence of Type I and I' pattern in females (50% and 27%, respectively) was significantly

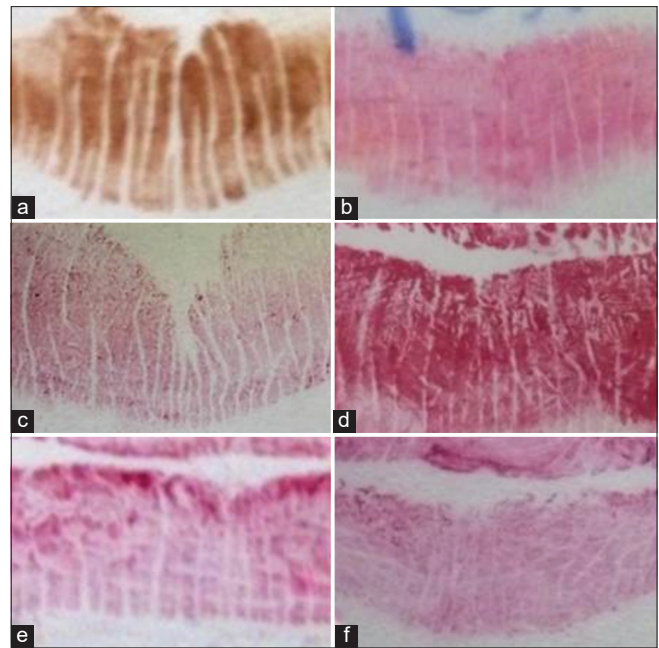


Figure 1: Types of lip print patterns obtained in the study according to Y. Tsuchihashi's classification. (a) Type I (Complete straight grooves); (b) Type I' (Partial straight grooves); (c) Type II (Branched grooves); (d) Type III (Intersected grooves); (e) Type IV (Reticular grooves); and (f) (Type V) Undifferentiated grooves

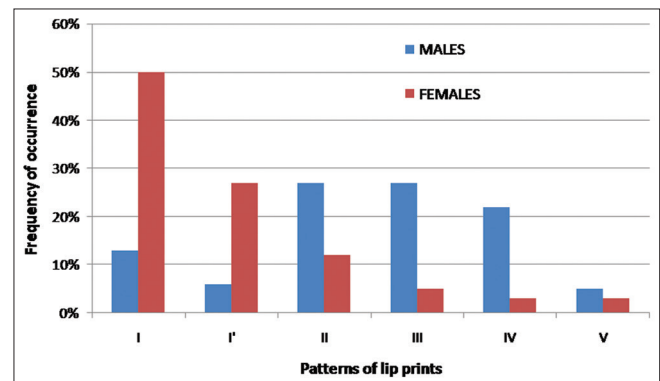


Figure 2: Frequency distribution of type of lip print patterns among males and females

higher ($P = 0.001$, 0.001 , respectively) compared to their frequency in males (13%, 6%, respectively)

- The frequency of occurrence of Type II, III, IV, and V was higher in males (27%, 27%, 22%, and 5%, respectively) compared to females (12%, 5%, 3%, 3%, respectively) but was non-significant ($P = 0.067$, 0.024 , 0.038 , 1.000 , respectively).

Heredit patterns (Figure 3)

- Among the 26 families (13 male and 13 female offspring), 21 offsprings (80.77%) showed resemblance to either of their parents indicating the significant role of heredity in establishing a particular pattern of lip grooves in the offspring. Of these 21 offsprings, nine were male (42.86%) and 12 were female (57.14%)

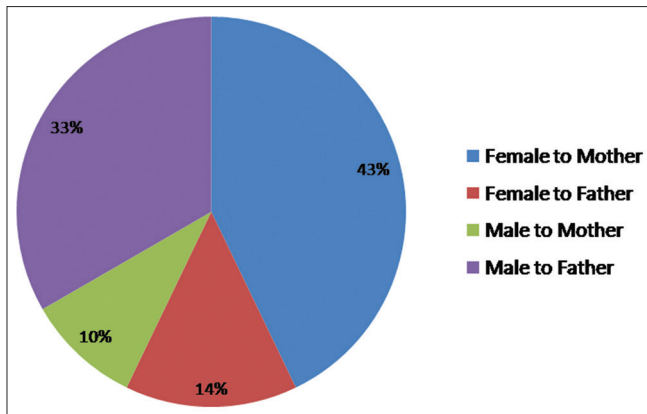


Figure 3: Frequency distribution of resemblance of type of lip print patterns of the offspring to the parents

- b. The resemblance of females to their mothers (36%) was the highest followed by resemblance of males to their fathers (28%). Both these observations were statistically significant ($P < 0.05$) when compared to resemblance of females to their father (12%) and males to their mother (8%).

DISCUSSION

Lip prints are gaining popularity in forensic sciences as they are easily recordable, unique, and remain stable over time. Furthermore, a high level of accuracy was obtained by some investigators in predicting gender employing cheiloscopy.^[2,10] The middle one-third segment of the lower lip was considered for analysis as this part is the most stable part of the lip and almost always present in any traces at crime scenes. These patterns on the lips are furrows or grooves formed during 6 months of intrauterine life and are genetically determined. They thought to be functional adaptations, serving as routes for flow of saliva over to lips to maintain hydration.^[11]

The predominance of particular patterns in a given population varies according to the geographical regions. Type V pattern was predominant in the Nigerian population,^[12] Type III in Japanese³ and Type I in Portuguese.^[4] Within the Indian population itself, various studies have shown varying results. Rastogi and Parida^[13] noted Type III and Type IV patterns predominant in North Indians and Type II in South Indians. Type III was commonly seen in Indo-Dravidian population^[11] and Type I in Mumbai population.^[14] Our study showed statistically significant predominance of Type I pattern in females and Type II and III in males. Various factors can be attributed to these differences in predominant patterns in different studies. The phenotype of an individual is a result of interplay between genetic and environmental factors. Thus, geographical variation plays a crucial role in influencing the pattern in individuals over a particular location. The way the lip muscles are relaxed during recording the print can also lead to variability.¹² The grooves are well-defined when the mouth is closed and ill-defined and difficult to interpret in open-mouth position.^[2] Finally, the method of analysis particularly the

segment of the lip studied and the subjective variations during analysis of the prints cannot be ruled out.

The present study also supports the role of heredity in the establishment of a particular pattern of lip prints in the offspring. Inheritance of lip prints has been proved by earlier studies^[7,8] too but the exact mode of inheritance is not yet determined. Females showed a greater resemblance to either of their parent compared to males. In addition, a statistically significant resemblance of females to their mothers and males to their fathers was found. Contrary to this finding, Augustine *et al.*^[7] observed sons' lip prints resembling more to their parents compared to females. The confirmation and significance of such observation await studies on large populations.

CONCLUSION

Cheiloscopy definitely shows gender variation and thus can be employed in sex determination. In our study, Type I was predominant in females and Type II and III in males. The utility of cheiloscopy in the determination of sex can be enhanced by the collection of data from different regions due to its geographical variations thus also providing a reference data for a particular locality. The methodology is simple, less time consuming and data can be preserved over a long period thus cheiloscopy can be effectively and efficiently used in mass disaster which requires analysis of a larger sample size.

Lip prints are inherited as the offspring showed a significant resemblance to either of their parent's lip print pattern. Moreover, the females showed a significant resemblance to their mothers. This broadens the scope of cheiloscopy in forensic sciences by facilitating the determination of parenthood. A study on a larger population is required to validate the findings. Most importantly, it is a proven crucial technique in forensics for personal identification and its admissibility in the Court of Justice.^[15]

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