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A Cheiloscopy Study of Lip Print Patterns in a Tribal Population: Influence of Age, Gender and Lip Pigmentation on Pattern Visibility

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Abstract

This research is based on analysing the lip print patterns and assess the effect of age, gender and lip pigmentation on pattern visibility in a tribal population of Betul district (Madhya Pradesh). A total of 100 persons (50 males and 50 females) were selected by random sampling. Lip prints were obtained by the lipstick method and classified according to the Tsuchihashi classification system. Age, gender and lip pigmentation data were recorded.

The analysis revealed the most common pattern was Type II (27%) followed by Type III (24%). Gender-wise variation was seen with Type II and Type III more common in females whereas Type IV and Type V had higher frequency in males. Visibility of lip prints increased with age and was significantly more prominent in subjects with pigmented lips.

The study has shown that cheiloscopy is a useful method for personal identification as a supplement to other methods, although the clarity of the pattern is affected by factors such as age and pigmentation.

Keywords: Cheiloscopy; Lip Prints; Forensic Identification; Lip Pigmentation; Tribal Population

Introduction

Cheiloscopy refers to the study of lip print patterns formed by grooves on the vermilion border of the lips. These patterns are unique to individuals and remain stable throughout life, making them valuable in forensic identification.

Lip prints develop during in utero period and are genetically determined. Their uniqueness is comparable to fingerprints, although exceptions may occur in monozygotic twins. In forensic investigations, lip prints can be recovered from crime scenes and used as corroborative evidence.

The most commonly used classification system is the Suzuki and Tsuchihashi classification, which categorizes lip prints into Types I, I′, II, III, IV, and V based on groove patterns.

Recent studies suggest that factors such as age, gender, and lip pigmentation may influence lip print visibility and pattern clarity. However, limited data exist regarding tribal populations, which highlights the need for this study.

Objective

- To study lip print pattern distribution.
- To compare male and female patterns.
- To analyze age influence on visibility.
- To analyze lip pigmentation and visibility.
- To evaluate forensic importance.

Materials and methods

The current study was designed and conducted within the Betul district (Madhya Pradesh) India, amongst 100 tribal individuals, aged between 16 to 60 years. The target population was chosen randomly with their verbal consent. Total sample constituted of 50 “Males” and 50 “Females”.

1.Lips surface was cleaned before sample collection.

2.A consistent Participants included 50 males and 50 females.

3.Layer of lipstick was applied to each subject’s lips.

4.Lip print was taken on clean white plain paper.

5.Care was taken to avoid blurred appearance and ensure clear prints.

6.Collected prints were permitted to dry properly.

7.Lip print patterns were analyzed using a magnifying lens (Linen testers).

8.Prints and their different pattern were classified into Type I, I’, II, III, IV, and V (according to the Tsuchihashi classification

system).

9.On the basis of Age, gender, and lip pigmentation were recorded.

10.Visibility of prints was noted as clear or poor.

11.Data were analyzed using frequency and percentage method. (Figure 1, Figure 2).

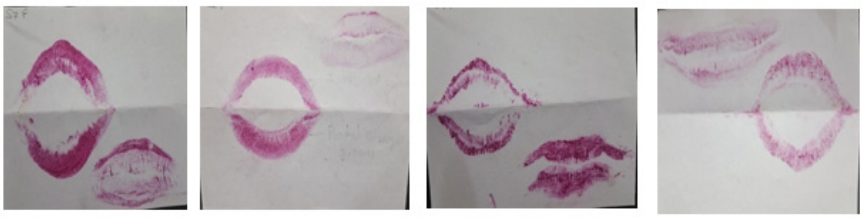

Figure-1a Figure-1b Figure-1c Figure-1d

Figure 1: 1a-1d Showing lip print samples of tribal individuals

Figure 2: Showing how sample collected on white paper

Data Analysis and Interpretation

The current study, conducted on 100 individuals, analyzed the distribution of lip print patterns and the influence of gender, age, and lip pigmentation on pattern visibility in cheiloscopy. Type II was the most predominant pattern (27%), followed by Type III (24%). Type I′ and Type IV each accounted for 16%, whereas Type I was observed in 13% of individuals, and Type V was the least common (4%), showing predominance of branched and intersecting groove patterns. Gender-based difference was noted, with Type II and III patterns more commonly observed among females, whereas Type IV and V patterns were more common among males, suggesting possible biological variation (Table-1).

Lip pigmentation also influenced visibility, as pigmented lips indicated greater clarity Pattern visibility showed enhancement with increasing age, with individuals in the 21–40 and 41–60 age groups showing clearer and more well-defined prints compared to those in the 16–20 group, likely due to development of lip grooves. Than non-pigmented lips, possibly due to enhanced contrast. In general, these findings show that lip print visibility is influenced by both pattern type and physiological fac-

tors such as age and pigmentation, which are significant for reliable forensic analysis.

Table1: Overall Distribution of Lip Print Patterns

Pattern Type	Frequency (n)	Percentage (%)
Type I	13	13%
Type I'	16	16%
Type II	27	27%
Type III	24	24%
Type IV	16	16%
Type V	4	4%
Total	100	100%

Observation Theory

1. Age

In this study, it was showed an increase that lip print visibility increased with growing age. Individuals in the higher age groups (21–40 and 41–60 years) showed clearer and more well-defined lip print patterns compared to those in the younger age group (16–20 years) (Table-2).

This observation may be theoretically explained by the maturation and stabilization of lip grooves over time. As age increases, the anatomical structures of the lips become more definedresultingin enhanced clarity of groove patterns. In distinguish, younger individuals may show less prominent grooves, resulting in comparatively reduced visibility.

Accordingly, age can be regarded as an important physiological factor influencing the clarity and interpretability of lip prints in Cheiloscopy.

Table 2: Age-wise Visibility Analysis

Age Group	Clear Visibility	Less Visibility	Total
16-20	20	12	32
21-40	32	9	41
41-60	22	5	27

2. Gender-wise Distribution of Lip Print Patterns

The present study indicates a variation in lip print patterns between males and females. Females mainly exhibited Type II and Type III patterns, while males showed a higher frequency of Type IV and Type V patterns. Type III was the most prevalent pattern in females, whereas Type IV was more frequently observed in males (Table-3).

These differences may be associatedwith biological variations such as differences in lip structure, tissue thickness, and hormonal influences, which affect groove formation. Females usually have finer lip tissues that prefer branched and intersecting patterns, while males tend to have thicker tissues contributing to reticular patterns. However, due to overlap in pattern types, cheiloscopy should be regarded only as a supportive tool for gender identification rather than a conclusive method.

Table 3: Gender-wise Distribution

Pattern Type	Male (n=50)	Female (n=50)
Type I	4	9
Type I`	2	14
Type II	9	18
Type III	3	21
Type IV	15	1
Type V	4	0

3. Pigmentation and Visibility

This study also showed a significant difference in lip print visibility based on lip pigmentation. Individuals with pigmented lips demonstrated greater clarity and more distinct lip print patterns, whereas non-pigmented lips were more frequently linked with faint or poorly visible impressions.

This can be theoretically attributed to the role of pigmentation in enhancing contrast. Increased pigmentation provides better differentiation of the lip grooves against the background, making the patterns more visible during examination. On the other hand, non-pigmented lips may produce low-contrast impressions, reducing the clarity of the observed patterns (Table-4).

Thus, lip pigmentation plays a crucial role in improving the visibility and reliability of lip print evidence in forensic analysis.

Table 4: Lip Pigmentation vs. Visibility Contingency

Lip Pigmentation	Clear Visibility	Poor Visibility	Total
Pigmented	47	15	62
Non-Pigmented	12	26	38

Result and Discussion

IN present study, conducted on 100 individuals mostly from a tribal population, analyzed the distribution of lip print patterns and the influence of gender, age, and lip pigmentation on pattern visibility in cheiloscopy. Type II was the most predominant pattern (27%), followed by Type III (24%). Type I′ and Type IV each accounted for 16%, whereas Type I was observed in 13% of individuals, and Type V was the least common (4%), showing predominance of branched and intersecting groove patterns. Gender-based variation was observed, with Type II and III patterns more frequent among females, whereas Type IV and V were more common among males; however, these differences require further validation through larger studies.

Pattern visibility improved with growing age, with the highest clarity observed in the 21–40 age group, followed by 41–60 years, and the lowest in 16–20 years, likely due to maturation of lip grooves. Lip pigmentation also significantly influenced visibility, as pigmented lips demonstrated clearer patterns than non-pigmented lips, possibly due to enhanced contrast. The inclusion of a tribal population provides insight into population-specific variations in lip print patterns. Overall, the findings highlight that, beyond pattern type, physiological factors such as age and lip pigmentation play a crucial role in the clarity and reliability of lip print evidence in forensic analysis.

Conclusion

This research provides valuable insight into the pattern distribution and visibility of lip prints in a population largely representing a tribal group within the scope of Cheiloscopy.

The predominance of Type II and Type III patterns indicates that these groove configurations are more commonly encountered in the studied population. Although variations were observed between males and females, gender did not show a consistent influence on lip print pattern distribution.

The study further demonstrates that lip print visibility is influenced by physiological factors. Increased age was associated with improved clarity of patterns, suggesting progressive stabilization of lip grooves over time. Additionally, lip pigmentation was found to enhance pattern visibility, likely due to improved contrast, making the grooves more distinguishable.

These findings emphasize that while lip prints are a reliable tool for personal identification, factors such as age and pigmentation must be considered during analysis to ensure accuracy. The study also highlights the importance of including underrepresented populations, such as tribal groups, in forensic research to improve the applicability of identification techniques.

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