

Patterns and Proportions A Dual-Method Approach to Gender Identification in Cheiloscopy

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Abstract—The purpose of this study was to compare the reliability of traditional lip print patterns (Suzuki & Tsuchihashi classification) with a mathematical approach (Lip indexing) for the gender identification in a sample of 100 individuals (50 males and 50 females) of Bhopal district (Madhya Pradesh). Lip prints were collected using a non-glossy lipstick and with the help of a standardized lipstick-on-paper method.

Through morphological analysis, it was determined that type II is the predominant pattern found in females (48%), while type I' is the most prevalent in males (44%). However, notable difficulties were observed due to variation within individuals, with single lips exhibiting 2-3 distinct patterns.

To address this qualitative subjectivity, the lip print index was used as objective variable for analysis. Result shows that male displayed a wider range of index value (70-150), whereas, female displayed more consistent values (80-110). These results suggest that, even if lip prints are distinct, the lip index provides a more reliable and consistent variable for determining sex than pattern analysis alone.

Index Terms—Cheiloscopy, Lip index, Sex determination.

I. INTRODUCTION

Cheiloscopy, or the study of lip prints, is used in forensic science as a method of personal identification because lip patterns are considered unique. The Suzuki and Tsuchihashi classification is commonly applied to categorize these patterns and has been used in several studies for sex determination.

However, in practical situations, its reliability is not always consistent. Lip prints can show more than one pattern in the same individual, and differences between the upper and lower lips further complicate

classification. In smaller sample sizes, these variations may lead to overlapping findings between males and females. In the present study of 100 individuals (50 males and 50 females), similar inconsistencies were observed, where no single pattern could be clearly associated with a particular sex.

To reduce this subjectivity, the present study evaluates the Lip Index as an additional parameter. As a quantitative measure, it may provide more consistent results compared to pattern-based analysis. This study therefore compares both methods to assess their effectiveness in sex determination.

It was observed during the study that pattern identification was sometimes difficult due to the presence of mixed or unclear patterns within the same lip. In some cases, the upper and lower lips showed different dominant patterns, making classification less straightforward. This kind of variation can affect the consistency of results, especially when the sample size is limited. Therefore, including a measurable parameter like the Lip Index may help provide a more stable basis for comparison and improve the overall reliability of the findings.

II. METHOD AND MATERIALS

The current study was designed and conducted within the Bhopal district (Madhya Pradesh) India, amongst 100 individuals, aged between 15 to 55 years. The target population was chosen randomly with their verbal consent. Methodology includes:

1. Preparation of subject: The lip surface of each participant was cleaned prior to sample collection to remove any debris, oil, or contaminants.

2. Application of lipstick: A uniform layer of non-glossy magenta pink lipstick was applied evenly to the lips of each subject.
3. Collection of lip prints: Lip impressions were obtained by asking participants to press their lips gently onto clean, white plain paper.
4. Quality control: Care was taken to avoid smudging or blurring to ensure clear and distinct lip prints.
5. Drying of sample: The collected lip prints were allowed to dry properly before further analysis.
6. Analysis of lip prints: The prints were examined using a magnifying lens to identify groove patterns clearly (Figure 1 a-Figure 1 d).
7. Classification of patterns: Lip print patterns were classified according to the Suzuki and Tsuchihashi

classification into Type I, Type I', Type II, Type III, Type IV, and Type V.

8. Lip index: A quantitative assessment was performed using the lip print index. Only vertical measurements were considered for this purpose. The vertical height of the upper lip and lower lip was measured in centimetre's using a calibrated scale from the collected lip prints (Figure-2). The lip print index was calculated using the following formula:

$$\text{Lip Index} = (\text{Height of upper lip} / \text{Height of lower lip}) \times 100$$

Figure 1a-1d: Images showing how sample collected on white paper

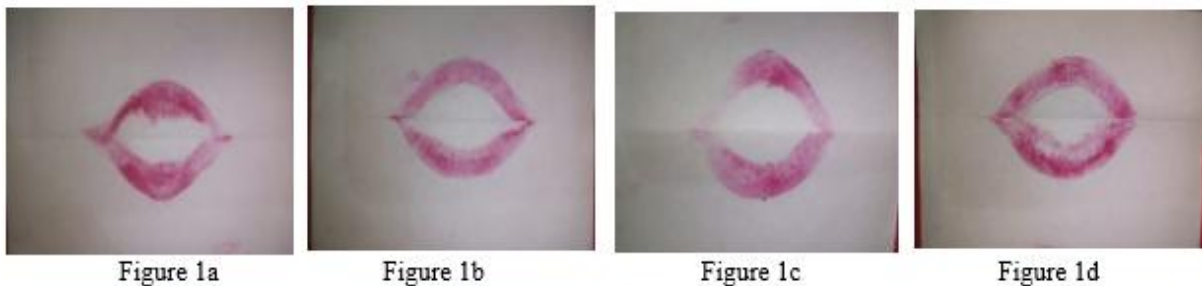


Figure 2: Image Displaying Lip Indexing



Figure 3: Real Lips Vs Lip Print

III. RESULTS

It is observed that Type I' (44%) was the most common lip print pattern among males, whereas Type II (48%) was the most predominant pattern among females. Type III pattern was observed only in females, while Type IV was least common in both genders (Table-1) and the majority of individuals fall within the 90–110 lip index range, indicating balanced lip proportions. A smaller percentage shows values below 90 and above 110. (Table-2). Table 3 shows that males exhibit a wider variation in lip index values compared to females, whose values are more consistent.

Table 1: distribution of lip prints among male and females

TYPE	MALES(50)	FEMALES(50)	TOTAL(100)
Type-I	09	12	21
Type-I'	22	02	24
Type-II	16	24	40
Type-III	0	05	07
Type-IV	03	07	08
TOTAL	50	50	100

Table 2: Lip index distribution

Lip Index Range	Males (%)	Females (%)	Interpretation
<90	20%	15%	Lower lip dominance
90-110	60%	70%	Balanced lips
>110	20%	15%	Upper lip dominance

Table 3: Gender wise lip index trend

Gender	Lip-index range	Observation
Males	70-150	Greater variation
Females	80-110	More consistent value

IV. DISCUSSION

The study was conducted to analyze the usefulness of lip print patterns and lip index in gender identification. After analyzing 100 samples, certain observations were made regarding both qualitative and quantitative aspects of cheiloscopy.

Based on lip print patterns, it was observed that Type I' pattern was more common among males, while Type II pattern was predominant among females. These findings match with some previous studies, indicating that certain patterns may show higher frequency in one gender. However, during the analysis, it was also observed that many individuals did not display a single uniform pattern across the lips. In several cases, different patterns were observed in different regions of the same lip print.

This variation made classification slightly challenging, as the identification of a dominant pattern sometimes depended on observation. Such overlap and variation indicate that lip print patterns alone may not always provide a consistent basis for gender determination.

Lip indexing was the most important part of current research study. While the patterns were overlapping, the Lip Index gave a clear, mathematical number for everyone. It was found that females are very consistent (80–110), but males have a huge range (70–150). This math removes the "guesswork" from the analysis. Even if a print is a bit smudged and can't see the patterns clearly, still measure the height and get an index value.

It was also found that "Lipstick quality" and "Pressure" matter a lot. If a participant pressed too hard, a Type I pattern could look like a Type III because the lines got smudged. This is a big limitation of the traditional method that the Lip

Index helps to solve, because even if a print is slightly smudged, still measure the total height of the lips.

V. CONCLUSION

This study shows that lip prints are a valuable and cost-effective tool for forensic identification. While traditional pattern classification (Suzuki and Tsuchihashi) is helpful, it is not always perfect because lip patterns can overlap or be difficult to categorize in "mixed" samples.

The most important finding of this research is that adding the Lip Index makes the identification process much more reliable. While Type II patterns were most common in females and Type I' in males, the mathematical consistency of the Lip Index provided a more objective "proof" for sex determination.

Essentially, this project proves that a "Dual-Method" approach—using both patterns and proportions—is much more accurate than using just one method alone. This combination reduces human error and provides a more scientific basis for using cheiloscopy in real-world forensic investigations.

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