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Original Research Article

Exploring Cheiloscopy Patterns in Tamil Nadu: A Comprehensive Analysis of Lip Print Variations among Students

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Article Info

Abstract

Introduction: India is one of the largest countries, inhabited by diverse populations comprising different tribes, castes, religious groups, and migrants. While the people of India share some common physical features, they also exhibit differences in their cultural, anthropological, and genetic traits**.** In this study, our objective is to analyse diverse lip print patterns in human subjects, considering both their gender and geographical background. **Materials and methods:** Our study includes five hundred randomly selected specimens, encompassing individuals of both genders and diverse regions from various districts of Tamil Nadu between 18 to 25 years. Participants with lip deformities, allergies to agents used during sample collection, and those experiencing lip inflammation were not included in our study. **Results:** The present study comprised 500 participants. The average age of the study population was 21.76 ± 1.894. The demographic distribution showed 51% males and 49% females. In the female population residing in all the major cities Type 2 was the most common compare to all the other types but in Madurai type 1 was more common. **Conclusion:** Given the uniqueness of lip prints for each individual, Cheiloscopy emerges as a valuable method for identification in forensic odontology. Consequently, the study underscores the importance of lip print analysis, or cheiloscopy, as a valuable adjunct for identification in the field of forensic odontology.

1. Introduction

The India is one of the largest countries, inhabited by diverse populations comprising different tribes, castes, religious groups, and migrants. While the people of India share some

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common physical features, they also exhibit differences in their cultural, anthropological, and genetic traits.[1]

In forensic investigations, personal identification holds utmost importance. It is typically based on the theory asserting that each individual is unique and can be identified based on distinctive features. The biological phenomenon of characteristic patterns observed on the vermilion border of lips was initially described by Fischer in 1902. However, it was Snyder in 1950 who proposed the use of lip prints as an identification tool.[2] A normal wrinkle and groove between the inner labial mucosa and outer skin are defined as lip prints, and the examination of these is known as cheiloscopy.[3] In 1970, Suzuki and Tsuchihashi presented the term "Sulci labiorum" for the lip prints comprising these grooves, labelled "FIGURALINEARUM LABIORUMRUBRORUM" The study of these lip prints, denoted to as cheiloscopy, is said to be unique to each individual, akin to fingerprints.[4]

The techniques employed in cheiloscopy are accorded the same significance as other forms of forensic evidence commonly used for personal identification and sex determination.[5,6] Suzuki and Tsuchihashi devised a lip print classification method in 1970, which remains the most widely used classification in literature.[7] In this study, our objective is to analyse diverse lip print patterns in human subjects, considering both their gender and geographical background. Additionally, we aim to identify any commonalities in specific patterns among the subjects. To the best of our knowledge, this study signifies the first instance in the literature where lip print analyses have been performed, comparing both genders and populations from various districts of Tamil Nadu.

2. Materials and methods

Subjects: Our study includes five hundred randomly selected specimens, encompassing individuals of both genders and diverse regions from various districts of Tamil Nadu. The age range for participants in our study is between 18 to 25 years, with a distribution of 255 males and 245 females.

Exclusion Criteria: Participants with lip deformities, allergies to agents used during sample collection, and those experiencing lip inflammation were not included in our study.

Ethical Considerations: Prior to sample collection, informed valid consent was obtained from each participant. Additionally, the study received approval from the ethics committee. The specimens were coded and documented in accordance with ethical guidelines.

Recording and Examination of Lip Prints: To record lip prints, we applied dark red or pink nonglossy, non-metallic lipstick with a single stroke evenly up to the vermilion border. The lipstick was applied onto cleaned and dry lips, left for 2 minutes, and then a lip impression was made on a strip of cellophane tape. This tape was then affixed to white, thin bond paper (A4 70 GSM). The impressions for different lip print patterns were observed under a 10X magnifying glass. The same method was consistently employed for obtaining impressions from all subjects. Each lip print impressions were classified into six patterns based on the classification given by K. Suzuki and Y. Tsuchihashi **(figure 1)**. All these data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS, ver. 17.0; SPSS Inc, Chicago, IL, USA). The level of statistical significance was kept at p ≤ 0.05.

Figure 1: Types of lip prints
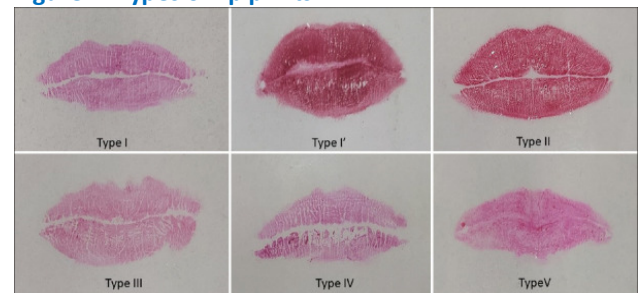
Type I – A clear-cut groove running vertically across the lip.

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 – Morphologically not differentiated (undetermined)

3. Results

The present study comprised 500 participants. The average age of the study population was 21.76 ± 1.894. The demographic distribution showed 51% males and 49% females **(Figure 2)**.

Geographically, 21% of the participants were from Chennai district, 20% were from Trichy, Coimbatore, Madurai district and 19% of the participants were from Tirunelveli district**(Figure 3)**.

In the male population residing in Chennai, Trichy and Coimbatore Type 2 was the most common compare to all the other types, in Madurai and Tirunelveli type 1 was more common compare to type

2 (Table 1). In the female population residing in all the major cities Type 2 was the most common compare to all the other types but in Madurai type 1 was more common (Table 2).
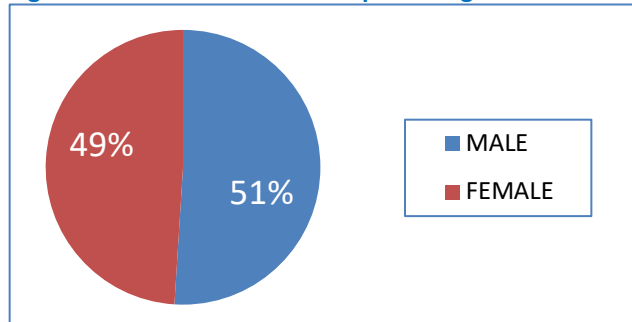
Figure 2: Gender distribution in percentage

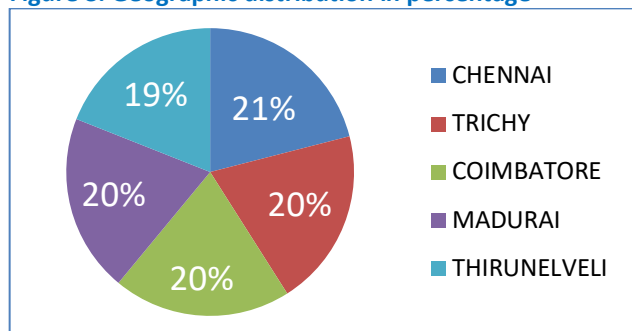**Figure 3: Geographic distribution in percentage**

Figure 4: Total distribution of lip print types

Table 1: Number of males in each zone (total - 255)

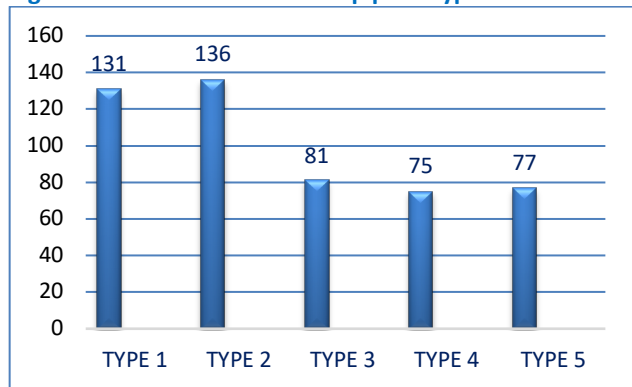| Zone	Type 1	Type 2	Type 3	Type 4	Type 5
Chennai	14	15	8	9	9
Trichy	12	14	9	8	8
Coimbatore	14	15	8	6	7
Madurai	13	12	9	8	9
Tirunelveli	14	13	6	9	6

Table 2- number of females in each zone (total- 245)

Zone	Type 1	Type 2	Type 3	Type 4	Type 5
Chennai	13	15	8	7	7
Trichy	14	15	8	8	6
Coimbatore	13	14	8	6	7
Madurai	13	12	8	7	9
Tirunelveli	11	11	9	7	9

Comparing both the genders in all the cities of Tamil Nadu type 2 was the most common (27.2%), type 1 was the second most common (26.2%) and type 4 and type 5 are seen least common compare to all the other types. (15%) (Figure 4).

4. Discussion

Determination of the identity of the person is one of the vital for conviction of the culprit.[8] Various methods of human identification exist, with fingerprint and DNA analysis being common techniques. Lip print patterns, unlike fingerprints and DNA, are permanent and remain unchanged even after death, except in monozygotic twins. These unique lip print patterns prove valuable in personnel identification and forensic investigations. In this study, we employed the conventional lipstick method for recording lip prints.

This study is the first to compare lip print patterns in Tamil Nadu population. When comparing different districts, no statistically significant differences were observed. However, a significant difference was noted between males and females for the 1st and 2nd type, while no significant difference was found for the other types.

The predominant lip print pattern observed in our study across state was Type 2 (refer to Table 1). This finding aligns with a study by Makesh Raj et al.[4], where Type 2 was common in the upper lip of males. Similarly, Dwivedi et al.[9] reported Type 2 as the most common pattern. Bharathi and Thenmozhi[5] found Type 2 to be predominant in the upper lip of males and in females, with Type 2 being most prevalent in the lower lip.

In the population of Madurai, Type 1 was the most predominant pattern, coinciding with Kapoor and Badiye's study in an Indian sample population.[3] This result also aligns with Ghimire et al.'s study in Nepalese students, where Type 1 was the most common pattern in both males and females. Ranjan et al.[10] found Type 1 to be the most common pattern in students from, Modinagar (Uttar Pradesh).

Studies by Alzapur et al.[11] and Vahanwalla and Parekh[12] also found Type 1 to be the most common lip print pattern in diverse populations. Kaul et al.[1] observed Type 1 as the most prevalent pattern in various Ethno–racial Groups in India. However, the present study contrasts with findings by Sivapathasundharam et al., Sharma et al., Verghese and Mestri, who confirmed that Type 4 was the most prominent pattern,[3,11,13,14,15] and Gondivkar et al. and Saraswathi et al.[16, 17] who showed Type 3 as the most

predominant type. Tsuchihashi's study on 1364 Japanese men and women revealed Type 3 as the most common in both genders. Loganadan et al.[18] conducted a study among Deutero-Malay population in Indonesia, finding Type 1' as the most dominant lip print type. Similarly, Bindal et al.[19], using samples from three races in Malaysia, observed Type 1' as the most common pattern.

5. Medicolegal implications

Forensic Identification: Lip prints, as a unique biometric marker, can enhance forensic identification practices. Our study provides evidence supporting the reliability and uniqueness of lip print patterns, potentially adding another tool for forensic odontologists and investigators.

Individualization and Uniqueness: Like fingerprints, lip prints are considered permanent and unique to each individual (except for identical twins). This characteristic strengthens their utility in cases where positive identification is crucial, such as in criminal investigations or disaster victim identification.

Gender and Geographical Variability: Our study highlights variations in lip print patterns based on gender and geographical location within Tamil Nadu. This data can assist forensic experts in narrowing down potential matches or excluding individuals based on these characteristics, enhancing the accuracy of identifications. Some researchers studied use of fingerprints for gender identification.[20]

Validation of Lip Print Classifications: By using Suzuki and Tsuchihashi's classification method and demonstrating its applicability in a diverse population, our study contributes to the validation and standardization of lip print analysis in forensic science. This can lead to wider acceptance of lip prints as admissible evidence in legal proceedings.

Ethical and Legal Compliance: Our study emphasizes ethical considerations, such as obtaining informed consent and securing ethical approval. Adherence to ethical guidelines ensures the validity and integrity of the data collected, which is crucial for legal acceptance and compliance with regulatory requirements.[21-23]

Scientific Foundation for Forensic Practice: Establishing the prevalence and distribution of lip print patterns in a specific population (Tamil Nadu) contributes to the scientific foundation of forensic odontology. This foundation supports the development of protocols and best practices for using lip prints in forensic investigations.

Education and Training: Findings from your study can inform educational curricula and training programs for forensic odontologists and investigators, enhancing their proficiency in using lip prints for identification purposes. [24-27] Some researchers studied fingerprints to establish identity of individual.[28]

Our research on lip prints has significant implications for enhancing forensic practices, improving identification accuracy, and ensuring ethical and legal compliance in forensic investigations. These implications underscore the importance of continued research and application of lip print analysis in forensic odontology and related fields.

6. Conclusion

Given the uniqueness of lip prints for each individual, Cheiloscopy emerges as a valuable method for identification in forensic odontology. Our study revealed Type 2 as the predominant pattern in the cities like Chennai, Trichy Coimbatore and Tirunelveli while Type 1 was prevalent in the Madurai population. The study concluded a statistically significant gender difference with variations in geographical locations. Consequently, the study underscores the importance of lip print analysis, or cheiloscopy, as a valuable adjunct for identification in the field of forensic odontology.

Ethical Clearance: IEC approval is taken from the Institutional Ethical committee.

Contributor ship of Author: All authors equally contributed.

Conflict of interest: None to declare.

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