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Digital Approach for Gender Identification from Lip Print Analysis in Western and Kokan Population of Maharashtra.

Abstract:

Background: Cheiloscopy is a forensic investigation technique that deals with identification of humans based on lips traces. Lip prints in each individual is unique like fingerprints. There are many methods for identification of lip prints given in literature. Digital photographs can be used to study the lip prints for gender identification.

Aim: The aim of the study is to identify the predominant lip print pattern in males and females in 18-40 years by using digital photographs.

Material and Methods: This analytical cross-sectional study included 150 subjects, comprising 75 males and 75 females from age 18-40 years. Digital photographs were used to identify the lip print patterns. The classification given by Suzuki and Tsuchihashi was used to further classify the lip patterns. Kappa test was applied to check for inter observer variation. Statistical analysis was done using SPSS version 23. The association between gender and lip print type was tested by Chi square test.

Results: We have found thatType I was the most common lip print among all participants followed by Type III . Type I' was the least common lip print followed by Type V in males. Type II was the least common pattern in females .These differences were found to be statistically significant.($p<0.01$).

Conclusion: Digital photographs has proved to be useful in terms of accuracy, reproducibility and forensic application.

Key-words: Cheiloscopy, Digital photography, Lip prints

Introduction:

Lip prints, also known as lip traces, are unique patterns formed by the arrangement of lines and ridges on the human lips. Lip prints can be classified into different types based on their characteristics, such as full lips, thin lips, and variations in the prominence of the ridges and lines.[1]

Cheiloscopy is the study of lip prints. Just like fingerprints, lip prints are unique to each individual and can be used for identification purposes. The term "cheiloscopy" comes from the Greek word "cheilos," which means "lips," and "skopein," which means "to see" or "to examine." In forensic science, cheiloscopy can be used as a tool to identify suspectsvictimsin criminal investigations. Lip prints can vary in their patterns and characteristics, such as wrinkles, furrows, and grooves, which forensic experts analyze to make identifications.[2

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Lip prints can be recorded in a number of ways.

1. On a non-porous flat surface such as a mirror they can be photographed, enlarged and overlay tracings made of the grooves.
2. Applying lipstick, lip rouge, or other suitable transfer mediums to the lips and then having the individual press his or her lips to a piece of paper or cellophane tape or similar surface

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3. Using a finger printer, preferably a roller finger printer.
4. By having the subject impress his or her lips (without lipstick or other recording medium) against a suitable surface and then processing these prints with either conventional finger print developing powder or with a magna brush and magnetic powder.[3]

In our research we have used digital photography for gender identification from lip print analysis. Digital photography can be utilized to capture high-resolution images of lip prints for various purposes, such as forensic analysis, medical diagnostics, or even artistic expression. Lip prints, like fingerprints, can be unique to individuals and may contain valuable information for identification or analysis. In forensic science, digital photography of lip prints can aid in criminal investigations by documenting and analyzing lip print patterns left at crime scenes. The high-resolution images captured can be compared to known lip print databases or used to identify suspects. In the medical field, digital photography of lip prints might be employed for diagnosing certain medical conditions or monitoring changes in lip health over time. For example, dermatologists might use digital images to track the progression of lip disorders or to document treatment outcomes.[4]Moreover, artists and photographers may find inspiration in capturing the intricate patterns and textures of lip prints, using digital photography as a medium for creative expression or exploration of identity and individuality. Overall, digital photography offers a versatile and efficient means of capturing and analyzing lip prints for a variety of purposes, ranging from forensic investigations to artistic endeavors. As this is the era of digitalisation, using digital photographs to identify lip print pattern could be an easy alternative to overcome these drawbacks. Therefore, this study is an attempt to study the lip print patterns for gender identification by using digital photographs.[5]

Aims And Objectives

Aim:

The aim of the study is to identify the predominant lip print pattern in males and females in 18-40 years(Group Matched) by using digital photographs.

Objectives:

- To identify predominant lip pattern in males and females
- To use digital photography to capture lip print details accurately, allowing for precise measurements such as grooves and branching.
- To identify the sex of an individual for criminal investigations.
- To develop data of lip print from known males and females for future research and forensic investigations.

Methodology:

Study design: Analytical Cross-sectional study.

Study setting: The study was carried out in YOGITA DENTAL COLLEGE AND HOSPITAL KHED.

Study population:75 Males and 75females, aged 18-40 years were examined who had visited Yogita Dental College &Hospital, Khed.

Sample size: Using previous literature, sample size was computed in G'power (3.1.9.2) software

Effect size – 0.32

*American Society of Anaesthesiologists Physical Status Classification System

Alpha error – 0.05

Power – 0.95

Sample size – 136 which was approximated off to 150. (75 in each group)

Inclusion criteria:

- Males and females of age 18-40 years will be examined.
- Subjects with positive informed consent and co-operative for the photographs.

Exclusion Criteria:

- Subjects having gross deformities of lip like cleft lip, ulcers.
- Subjects having traumatic injuries and previous lip surgeries.
- Subjects having habit of mouth breathing, tobacco smoking and those who have missing anterior teeth.

Methods:

After obtaining approval from the institutional ethical committee, a consent form was made and this analytical cross-sectional study was conducted in the institute Yogita Dental college and Hospital, Khed in June 2024. All the subjects were explained about the purpose of study and informed consents were obtained. The subjects were made to stand straight with the head aligned in a Frankfurt plane. The lip photograph was taken in natural state without any application of lipstick, lip gloss or lip filler. The subjects were photographed using mobile camera of iPhoneXR. For analysis central portion of lower lip (10 mm wide) was considered (refer fig 1), as this area is always visible even in

small fragment and also due to numerical superiority of lines in the area of study.

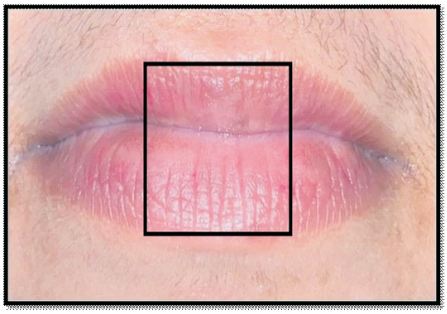


Figure :Photograph of subjects lip.

The classification given by Suzuki and Tsuchihashi was used to further classify the lip patterns(Fig.2)

Type I: Long vertical (clear-cut vertical grooves that run across the lips)

Type I': Short vertical (partial length groove of Type I)

Type II: Branched grooves (branching Y-shaped pattern)

Type III: Intersected grooves (criss-cross pattern)

Type IV: Reticular pattern (grooves that form a rectangular pattern)

Type V: Mixed/Indefinite (grooves that do not fall into any of the above categories and cannot be differentiated morphologically/ undetermined)

Type of Groove	Name	Illustration
I	Complete vertical grooves	
I'	Partial thickness vertical grooves	
II	Branched or forked grooves	
III	Intersected grooves	
IV	Reticular grooves	
V	Miscellaneous grooves	

Figure :2 Suzuki and Tsuchihashi classification.

Figure : 3 Taking visual records of female lip prints

Figure :4 Taking visual records of male lip prints through photography.

Results:

Frequency distributions of subjects based on the gender	
GENDER	**N (%)**
Male	75 (50.0 %)
Female	75 (50.0%)
Total	150 (100%)

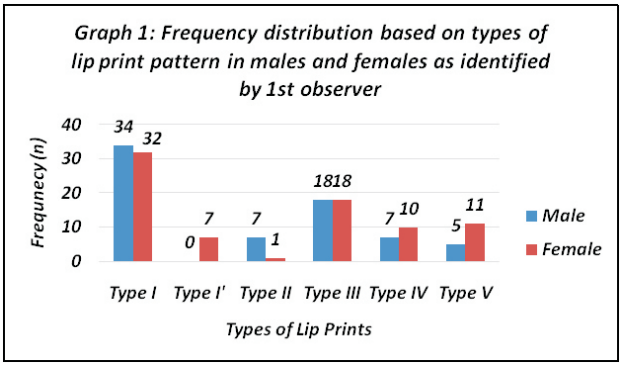
Table 1: Frequency distributions of subjectsbased on the gender.

Frequency distribution of subjects based on type of lip prints identified byfour observers				
Type of Lip Print	**Observer 1**	**Observer 2**	**Observer 3**	**Observer 4**
Type I	66 (44.0%)	65 (43.3%)	57 (38 %)	55 (36.7%)
Type I'	7 (4.7%)	3 (2.0%)	13 (8.7%)	10 (6.7%)
Type II	8 (5.3%)	10 (6.7%)	12 (8.0%)	11 (7.3%)
Type III	36 (24.0%)	36 (24.0%)	42 (28.0%)	44 (29.3%)
Type IV	17 (11.3%)	17 (11.3%)	14 (9.3 %)	15 (10.0%)
Type V	16 (10.7%)	19 (12.7%)	12 (8.0%)	14 (9.3%)
Total	150 (100%)	150 (100%)	150 (100%)	150 (100%)

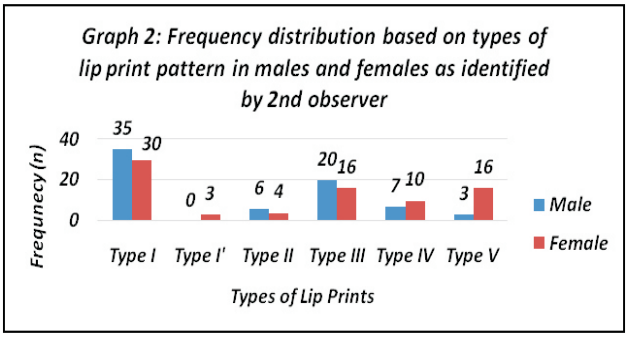
Table 2: Frequency distribution of subjects based on type of lip prints identified by four observers

Lip print patterns: males versus females			
Observer	Chi - square	df	P value
Observer 1	13.953	5	.016*
Observer 2	13.264	5	.021*
Observer 3	13.790	5	.017*
Observer 4	17.566	5	.007**
*P < 0.005 - * - significant*			
*P < 0.001 - ** - highly significant*			
P > 0.05 - # - not significant			

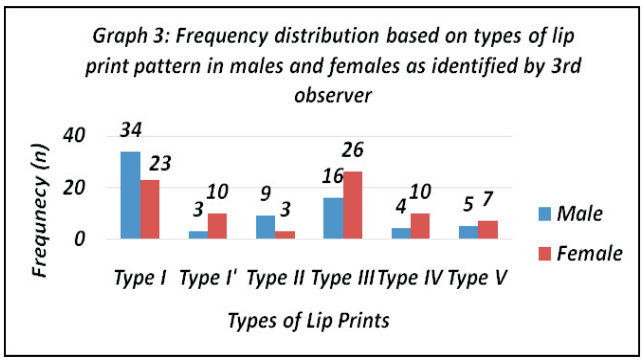
Table 3: Lip print patterns: males versus females



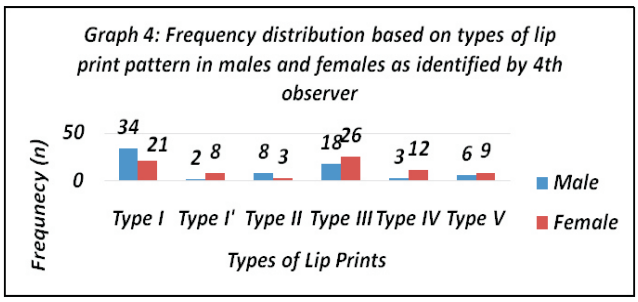
Interpretation: According to observer 1 Type I was the most commonly found lip prints in both males and females.



Interpretation: According to observer 2 Type I was the most commonly found lip prints in both males and females.



Interpretation: According to observer 3 Type I was the most commonly found lip prints in both males and females.



Interpretation: According to observer 4 Type I was the most commonly found lip prints in both males and females.

Discussion:

Lip prints are considered as an important aid in forensic investigation and gender identification. They are considered as analogous to finger print and most important forms of transfer evidence.[6] They are unique and don't change throughout the life of a person. It has been verified that they recover even after inflammation, trauma, and diseases like herpes virus infection. They are different even between twins which highlights the fact that it is unique for an individual.[7] Lip prints are usually left at crime scene. Analysis of these prints and comparison with those of the suspected person may be useful for identification. In some cases when sufficient evidences are not there for direct match, they can serve as the means for identification of gender and narrow down the investigation by half. Several methods have been reported in literature for recording the lip prints. The conventional lipstick method that has been widely used in literature has its own drawbacks. The major drawback with this method is that it is difficult to store the prints for longer time without distortion. This in turn makes difficult to create a comprehensive database. Apart from this, most of the male subjects hesitate to participate in study, as it requires application of lipstick. Therefore, in this study we have tried to study the lip prints pattern for gender identification by using digital photographs. Though the lines and furrows are present in both upper and lower lip, only the middle portion of lip is mostly taken into consideration. Sivapathasundaram et al. has suggested the middle part of lower lip (10 mm wide) as the most suitable area to study the pattern of lip print as this is almost always visible in any trace.[1]In the present study, we have considered the same area to identify the pattern of lip print. Among 150 study participants, Type I was the most common lip print followed by Type III. Our findings are in agreement to the findings of previous studies done in Nepalese population who also reported Type I to be the most common lip print in their study.[6]. Badiye and Kapoor studied the morphologic variation in lip print pattern in central Indian population and found that Type IV was most prevalent and Type III was least prevalent lip print in these population.[5] In our study, the most common type of lip print

in male was Type II and in females was Type I and these differences were found to be statistically significant. Our findings are in accordance to the findings of Bajracharya et al. who also reported Type II and Type I to be the most common lip print type in males and females respectively.[8]Badiye and Kapoor also reported Type II to be most predominant pattern in males.[5]Sharma et al. reported Type I to be most predominant pattern in females.[9] These findings are similar to our findings. However, in contrast to our findings, Randhawa et al. reported Type III to be the most common pattern in males but for females they also reported Type I as the predominant pattern.[10]Jatti and Rastogi reported Type II to be the most common pattern in both males and females in south Indian population.[11] Nevertheless, these variations could be due to different race and ethnicity. Studies have shown that lip print varies depending on ethnic and racial differences.[12].Thus, through this study we have tried to study the lip print pattern by using digital photography method. This method overcomes the flaws of conventional lipstick methods such as spoiling of prints due to smudging of the lipstick. Hence, the authors recommend the use of digital photographs for study of lip print for various purposes including research.

Conclusion:

Digital photographs offer significant advantages in the analysis of lip prints, particularly in terms of accuracy, reproducibility, and forensic application. However, careful attention to standardized procedures and the integration of technology is crucial to maximizing their potential in forensic science and research**.**Lip prints can be considered as an adjunctive tool in identification of gender. The use of digital photograph can be very useful in creating the comprehensive database that might be useful for future references.

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