



## **Analysis of Lip Print for Gender Identification in Karachi (Pakistan) Population**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** The grooves and wrinkles over the sulci labiorum forms a specific pattern called lip print. Cheiloscopy is the study of lip printing. Lip prints are unique to an individual similar to finger prints and thus support in personal identification.

The aim of this study was to evaluate gender dimorphism by Cheiloscopy and to find out predominant lip patterns in Karachi population.

**Study Design:** This is a cross sectional study.

**Place and Duration of Study:** The study was conducted at different campuses of Ziauddin Hospital and Al-Zohra Welfare Association, Karachi from July 2016 to January 2017.

**Methodology:** The study population included 456 Pakistani subjects (253 males and 203 females) of aged 15 to 55 years. Lip print patterns were noted and studied according to Tsuchihashi's classification. Chi square test was used for data analysis, p-value of  $\leq 0.05$  was considered to be the level of significance.

**Results:** A significant association was found between gender and lip pattern among Karachi population. The most common lip pattern in females were found to be type II followed by type III, where as type I', type V, type IV and type I. However, in males type III was most dominant followed

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by type II, type I, type I', type V and type IV are also to be found. In Karachi population Type III lip pattern was found to be predominant in 44.51% individuals followed by Type II in 31.6% individuals. **Conclusion:** The study showed that lip prints hold a potential identity to the gender and population. This can be used as a supplemental tool for forensic science.

*Keywords: Cheiloscopy; lip print; gender dimorphism.*

## 1. INTRODUCTION

Forensic identification plays a very important role in any crime investigation [1]. The wrinkles on the labial mucosa (lip prints) have individual characteristics like fingerprints [2]. Use of lip prints in personal identification was first suggested in France by Locard Synder in 1902 [3,4]. Tsuchihashi suggested classification of different types of lip print [4].

- Type I : Clear cut vertical grooves that run across the entire lip.
- Type I' : Similar to type I but do not cover the entire lip.
- Type II : Branched grooves.
- Type III : Intersected grooves.
- Type IV : Reticular grooves.
- Type V : Groove does not fall in any of the above type and cannot be differentiated morphologically

Lip prints do not change throughout the life. The lip prints recover after minor trauma, inflammation and Herpes [5,6]. The edges of the lips have sebaceous and sweat glands, enabling the secretion of oil and moisture to provide detectable prints at a crime scene from glass, cutlery, clothing, food, doors, windows and cigarette butts [6-9]. Many times the material with which a criminal may come in contact is unlikely to receive finger prints as criminal taking precaution for covering his hand with gloves. Cheiloscopy is an auxiliary method of identifying crime scene for detecting gender, number of people, occupation, ethnic group, habits and pathological change of the people involved. Cheiloscopy was reported to be an evidence of the cases that are as follows, 85 cases including 65 burglary, 15 homicide and 5 assault cases [6, 10].

Literature review reveals that lip prints can be successfully used as a medium for population and gender identification [6-9,11]. Cheiloscopy is applicable for identification at crime scene, since lip print provides a direct link to the suspect. Lip print recognition by CCD (coupled charged device) Camera is now linked with retina/ iris and

face patterns. Lip prints can be easily traced by using lysochrome, redescend reagent, Nile red, aluminum powder, cobalt oxide and magnetic powder [12].

The objective of this study was to evaluate lip prints for gender dimorphism among Karachi population. Unfortunately, there is no data available in our country regarding Cheiloscopy. Therefore, the present study was designed to analyze lip patterns to discriminate gender followed by identifying population.

## 2. MATERIALS AND METHODS

A cross sectional study was conducted at different campuses of Ziauddin Hospital and Al-Zohra Welfare Association, Karachi from July 2016 to January 2017. Data were collected using convenience sampling technique. 456 Pakistani subjects were included in the study. The inclusion criteria for sample selection were subjects with complete dentition and good oral hygiene, aged 15-55 years. Nationality of the participants was screened. Subjects with history of major trauma leading to scarring or any surgical treatment affecting the size and shape of lips were excluded from our study. Individuals having developmental anomalies, lip hypertrophy and allergy to lipstick were also excluded from the study. WHO sample size estimation calculator was used.

The study was conducted after approval from ethics review committee of Ziauddin University. After getting informed consent signed, lips were cleaned using wet tissue paper. Lip stick was applied to the lips in a single motion. Cellophane tape strip (10 cm long) was cut with scissor. The subject was asked to put his lips on the tape with even pressure. Cellophane tape was carefully removed, applied on white bond paper and tagged with a serial number. The prints were visualized with magnifying glass. Each lip print was divided into six zones such as right upper lateral, upper middle, left upper lateral, left lower lateral, lower middle and right lower lateral zones but only lower lip middle third (zone 5) was analyzed. [Fig. 1] as the middle part of lower lip, are the most visible, reliable portion and thus

provides good evidence at crime scene as proposed by Sivpathasundaram [2].

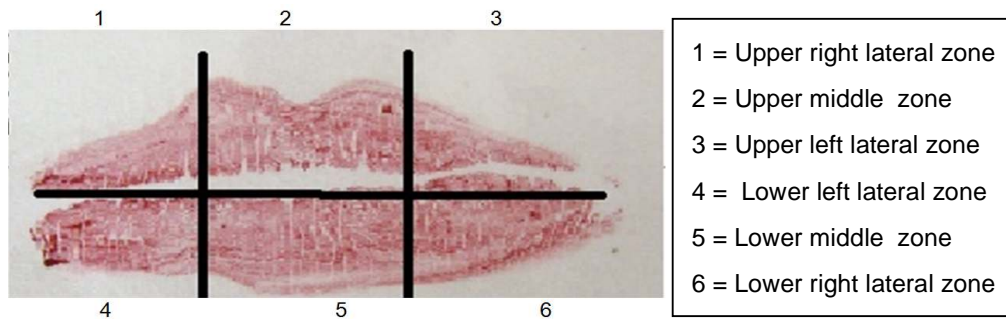
Lip patterns were recorded and categorized by the classification given by Tsuchihashi et al. [1] who divided lip prints into five types that are explained in the under mentioned figure. [Fig. 2].

- Type I : Clear cut vertical grooves that run across the entire lip.
- Type I' : Similar to type I but do not cover the entire lip.
- Type II : Branched grooves.

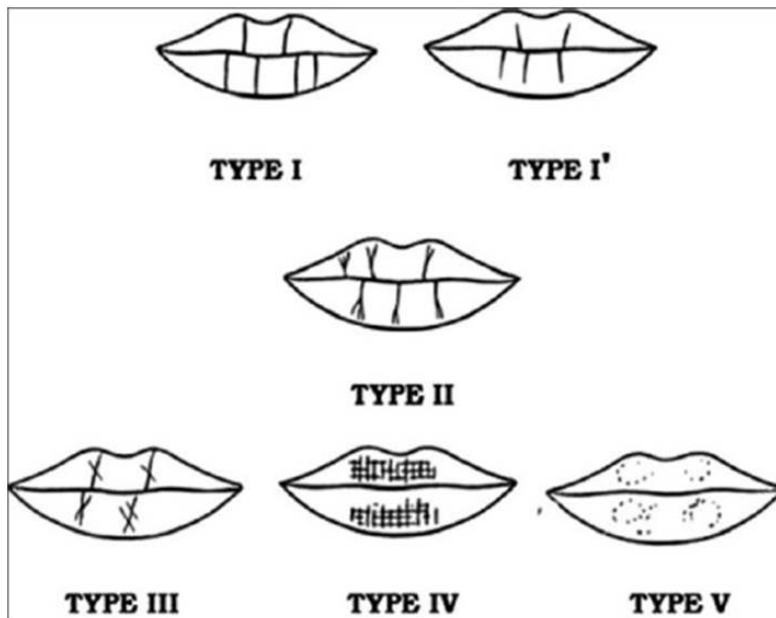
- Type III : Intersected grooves.
- Type IV : Reticular grooves.
- Type V : Groove does not fall in any of the above type and cannot be differentiated morphologically

## 2.1 Statistical Analysis

For the analysis of given data SPSS version 20 is chosen. Whereas, chi square test is administrated for detailed calculation of the data. For the following study p value  $\leq 0.05$  is found to be the level of significance.



**Fig. 1. Diagrammatic representation of different zones of Lip**  
 (Sara Gardezi, 2017. Department of Orthodontics, Ziauddin University, Karachi)



**Fig. 2. Diagrammatic representation of different Lip patterns from Tsuchihashi's classification**

### 3. RESULTS AND DISCUSSION

#### 3.1 Results

The most predominant lip pattern found in Karachi population was type III(44.51%) followed by type II (31.57%), type I(7.01%), type I'(6.8%), type V(5.48%) and type IV(4.60%) (Fig. 3).

Chi square was used to determine gender dimorphism among Karachi population. The most common lip pattern in females was found to be type II followed by type III, type I', type V, type IV and type I. However, in males type III lip pattern was dominant followed by type II, type I, type I', type V and type IV, (P-value = 0.017) as shown in Table 1.

#### 3.2 Discussion

Human identification is the latest trends for patternizing the civilization. It helps in identifying and classifying individuals into characteristic groups of age, gender and race.

Identification of humans by using the unique features of the teeth and jaws are in scientific venture since from Roman times [4]. Forensic odontology is the branch of dentistry which deals with examination of dental evidence and presentation of dental findings in the interest of justice [7] Cheiloscopy is an adjunct investigation for identification of criminals [13]. Lip patterns are unique in their morphology [6,7]. They are considered as the most important form to evident, and are analogous to finger prints. [13,14] Cheiloscopy in forensic dentistry is still scarce in literature.

Pakistan because of its strategic geographical location and sharing border with various countries has a monumental influx of migrates. Karachi is the largest cosmopolitan city of Pakistan having multiple ethnic groups. Therefore, Karachi is a special entity which is needed to be explored more.

In our population type III lip pattern was most prevalent. Tsuchihashi et al. [1] in their study on Japanese population and Narang et al. [15], from

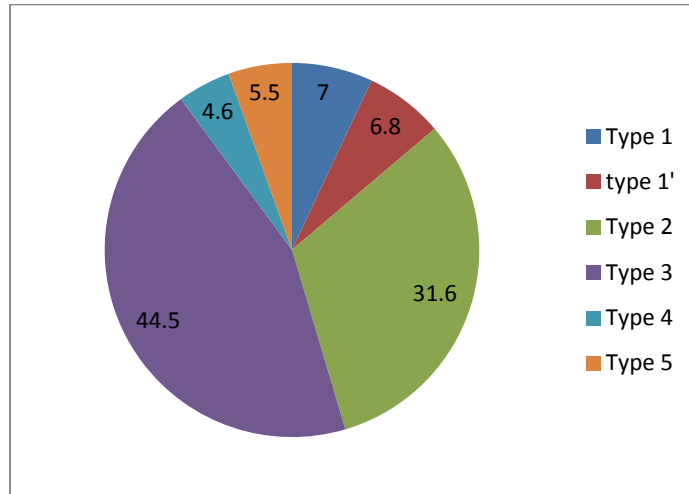


Fig. 3. Frequency of different lip patterns among Karachi population  
N = 456

Table 1. Gender dimorphism in Lip Pattern of Karachi population

Lip Pattern	Male		Female		p-value
	N	%	N	%	
Type I	24	9.5	8	3.9	0.017*
Type I'	14	5.5	17	8.4	
Type II	47	18.6	97	47.8	
Type III	143	56.5	60	29.6	
Type IV	12	4.7	09	4.4	
Type V	13	5.1	12	5.9	

\* P-value ≤ 0.05 is significant

India- Punjab have also reported type III lip pattern prevalence [1,15] However, in our study Type III lip pattern was followed by type II, type I, type I', type V and type IV. We could not find any study showing similar results as ours.

A study by Syed Wali Peeran et al. on Libyan population showed prevalence of Type I, followed by type II, type III, type IV, type V and type I' [16]. Another study by Mohfeghi et al. on Iranian population, reported type V as the predominant of all followed by type I, type II, type IV and type I' [17]. According to Vats et al. type I' was predominant followed by type II, type III and type I in Indian Brahmins [18]. Singh J et al. found type I lip pattern to be most common followed by type III, type IV, type II, and type V in Moradabad (India) population [19].

These results strongly suggest that each population has a specific lip pattern. The difference is perhaps due to different genetic upbringing.

In the present study the most common lip pattern for males were found to be type III followed by type II, type I, type I', type V and type IV. We could not find any study which exactly matched our pattern. However, Vats et al, and Vahanwala et al, from India have reported type III to be the most common lip pattern in males which is comparable to our study [11,18] Gupta et al. reported that in North Indian males the most common lip pattern was type II which differs from our results [8].

In our study the most common lip pattern for females was found to be type II followed by type III, type I', Type V, type IV and type I. In Mangalore females it has been reported by Gaba et al, that type II lip pattern was predominant followed by type III and type I' [20]. In agreement to our results Gugutothu et al, also found type II to be most common in Andhra Pradesh females. [21] This is comparable to our results in females. However, our results do not match with those of Moshfeghi et al, from Iran who reported the predominance of type V lip pattern followed by type I and type II in females [17]. Another study conducted on Libyan population does not support our results as it reports the predominance of type I lip pattern followed by type II in Libyan females [16].

Our study reports gender differentiation on the basis of most common lip pattern which was type

III in males and type II in females. In the recent years, some authors have claimed differences in lip print patterns of males and females. Our results are in accordance with those of Costa and Caldas, who in 2012, studied a group of Portuguese population and reported type III to be the most dominant lip pattern in males (52%) and type II to be the predominant lip pattern in females (44%) [22]. Like our study Singh *et al* have also reported that type III was most commonly seen in males (43.3%) but their results for females differed from ours as they showed type I to be the most common lip pattern(46%) for females [19].

#### 4. CONCLUSION

A distinctive lip pattern is found in the population at least in this part of the world. Lip print pattern among Karachi population showed significant gender dimorphism. Lip prints have great utility in gender identification and should be examined in detail on a larger sample size and in different ethnicities of Pakistan for further validation of results.

#### CONSENT

A written informed consent was obtained from the patient (or other approved parties) for publication of this study.

#### ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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