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# Cheiloscopy–A Deterministic Tool for Forensic Sex Determination

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## ABSTRACT

**Introduction:** Establishment of personal identity in forensic science involves chiefly determination of sex, race, age and stature .If the sex of an individual is known, it can be helpful to exclude a large number of suspects from the investigation. Cheiloscopy is an upcoming tool for determination of sex of an individual.

**Objective:** The aim of the study was to determine whether cheiloscopy behold the potential for determination of sex.

**Materials and Method:** The study was conducted on 100 students, 50 males and 50 females belonging to the age group of 18-23 years. Lip prints were recorded by applying lipstick and then transparent cellophane tape to the lips which was then stuck to a white bond paper. They were studied and classified by two separate examiners. The results were statistically analyzed using percentages and applying Chi – square test for goodness of fit to see the difference in types in the two sexes .

**Result:** No two lip prints matched each other. The commonest lip print pattern was Type I in females and Type IV in males. The percentage of accuracy was 89% for examiner1 and 91% for examiner2 in correct sex identification. The results were statically significant.

**Conclusion:** This study reveals that lip prints are unique and cheiloscopy beholds the potential for determination of sex.

**Key words:** Cheiloscopy, Lip prints, Sex determination.

## INTRODUCTION

With the ever increasing demands upon law enforcement agencies to identify the criminals, any type of personal trait should be used to provide sufficient evidence to link a perpetrator to the crime[1]. Establishment of personal identity in forensic science involves chiefly determination of sex, race, age and stature. If the sex of an individual is known, it can be helpful to exclude a large number of suspects from the investigation[2]. Besides the use of modern and reliable techniques like DNA, dactylography, etc the less utilized equally flawless techniques can also be applied when the former methods fail to establish positive identity. Cheiloscopy fall into this category of adjuvant techniques[3]. They are as reliable and unique as fingerprints in identification of a person except in uniovular twins where they are identical in contrast to fingerprints[4,5,6].

Cheiloscopy is the study of lip prints which are normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of human lip between inner labial mucosa and outer skin[7]. Lip prints are unique and do not change during the life of an individual [6,8,9]. It has been proved that they recover after undergoing changes due to trauma, inflammation and diseases like herpes and also the environmental factors do not produce any change in the lip print patterns[10].

Lip prints can be found on a number of items at the scene of crime like cigarette ends, cups, glasses, clothing, etc[11, 12, 13]. These are most commonly found in cases of rape, burglary and murder. Latent lip prints can be made visible with either conventional finger print developing powder or with a magna brush and magnetic powder.[8]

R.Fischer was the first to describe lip print patterns in 1902.[6, 9, 12, 13, 14] However, Edmond Locard, a French criminologist, recommended the use of lip prints in identification of individuals in 1932. Two Japanese scientists, Y. Tsuchihashi and T. Suzuki in the period 1968-71, established the individuality and uniqueness of lip prints for each human being.[9]

**Objective:**
The aim of the study was to determine whether cheiloscopy behold the potential for determination of sex.

## MATERIALS AND METHOD

A total of 100 students, 50 males and 50 females, of FMH College of Medicine & Dentistry were included in the study. All belonged to the age group of 18-23 years. The subjects with trauma, inflammation or congenital malformations of lips were not included in the study. Those with known hypersensitivity to lipstick were also excluded. All lip prints were taken by single personnel to reduce the chances of error. A non- glossy bright red lipstick was applied to the vermillion border of the lips in a single stroke. The subject was then asked to rub the lips together to ensure even application of lipstick. Lip print was then taken by applying the glued portion of the transparent cellophane tape to the lips. It was then stuck to the white bond paper. This served as a permanent record. Because of the numerical superiority of properties of the lines and its visibility in almost every trace, the middle part of the lower lip (10-mm wide) was selected as the study area, as given by Sivapathasundaram et al [6].

The lip prints were then studied with the help of magnifying glass by two separate examiners. The lines and furrows present, their length, branching and combinations were noted. They were classified according to classification given by Suzuki and Tsuchihashi as shown in fig.1: [9]



**Fig. 1:** Suzuki Classification

The lip prints were coded keeping in account the name and sex of the respective individuals. At the time of study of the lip prints, the sex was not disclosed.

Sex of the individual was determined as proposed by Vahanwala et al [15,16]:

1. Type I and I' patterns dominant: Female
2. Type I and II patterns dominant: Female
3. Type III pattern dominant: Male
4. Type IV pattern: Male
5. Type V showing varied patterns: Male

The results were then verified from the coded data collected at the beginning of the study.
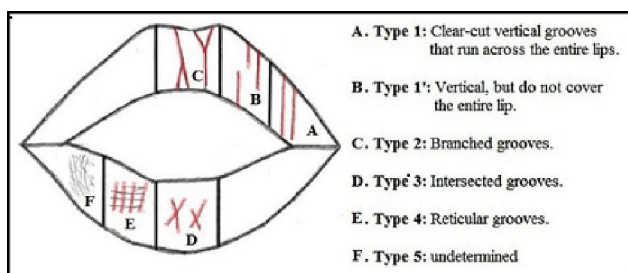
The statistical analysis included calculation of percentages and application of test of significance like Chi- square test for determination of difference in the lip print patterns among males and females .

## RESULTS

Our study was conducted on 100 students, 50 males and 50 females, of FMH College of Medicine & Dentistry, Lahore belonging to the age group of 18-23 years.

In our study, no two lip prints were identical thus establishing the uniqueness of lip prints.

The study showed that the predominant lip print pattern was Type I in females (54%) and Type IV in males (26%) as shown in table. 1 and fig.2
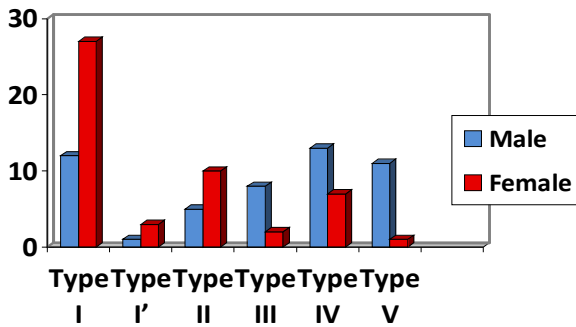
**Table 1:** Gender Distribution of lip prints according to type

| Gender | Type I | Type I' | Type II | Type III | Type IV | Type V |
|--------|--------|---------|---------|----------|---------|--------|
| Male | 12 | 1 | 5 | 8 | 13 | 11 |
| Female | 27 | 3 | 10 | 2 | 7 | 1 |

## ORIGINAL ARTICLE



**Fig. 2:** Distribution of lip prints according to gender

The above data was statistically analyzed to determine the difference in types in the two sexes and its significance. Chi – square test for goodness of fit showed $x^2$=22.169; df =5; p=0.00048; Highly significant.

The first examiner recognized correctly 43 males out of 50 and 46 females out of 50 on the basis of their lip prints registering accuracy percentage of 86% and 92% respectively as shown in fig. 3
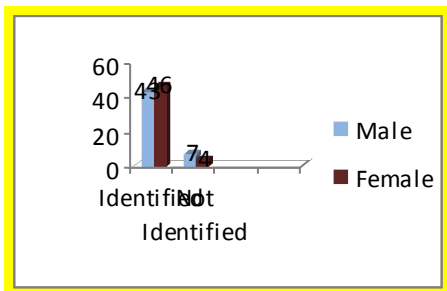


**Fig. 3:** Identification of Gender by first examiner
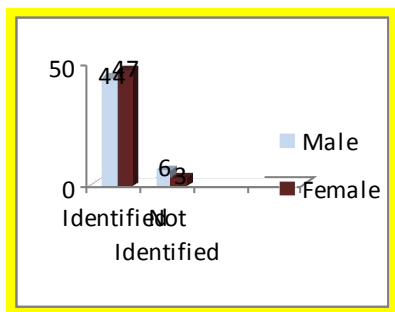


**Fig. 4:** Identification of Gender by second examiner

The second examiner recognized 44 males out of 50 and 47 females out of 50 correctly on the basis of their lip prints thus showing accuracy of

88% for males and 94% for females as shown in fig. 4

Overall out of 100 subjects, the first examiner identified 89 while the second examiner identified the sex of 91 with accuracy of 89% and 91% respectively (fig.5)
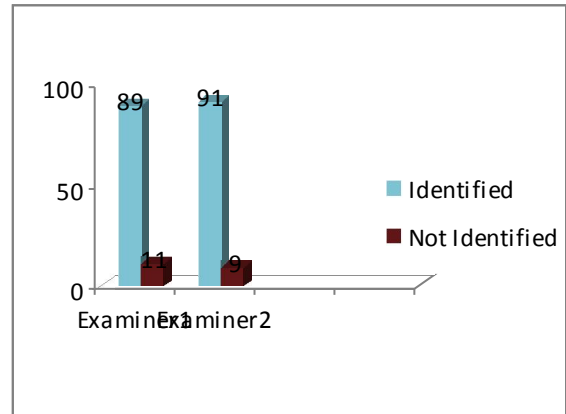


**Fig. 5:** Accuracy percentage of examiners

## DISCUSSION

Establishment of identity of living or deceased by using unique traits and characteristics is a corner stone of forensic science [17, 18]. The morphology of lips and their patterns found on variety of surface forms at the scene of crime comprise a very useful additional tool for personal identification[9,14, 19]. A lip print found at the scene of crime can give conclusive evidence about the nature of crime, number of persons involved, their sexes, habits, occupations and pathological changes of lips[1].

Although the lines and furrows are present both on upper and lower lips commencing from one corner of mouth to the other corner, only middle portion was studied because this portion is always visible in any trace as it is not uncommon to find partial lip prints at the scene of crime.[6,15] We labeled a particular pattern on the basis of the numerical superiority of types of lines present that is vertical, intersected, branched or reticular. If more than one pattern predominates it is typed as undetermined.

No two lip prints matched each other in our study. This is in accordance with the study by Y. Tsuchihashi and T. Suzuki involving 1364 Japanese subjects.[9] This dissimilarity among lip prints was also reported by El Domiaty et al in 2010 in their study of lip-print patterns in Saudi males and females thus supporting our findings.[20]

In the past, some researchers have tried to establish a relationship between lip print patterns

and gender of the individual and detected DNA in latent lip prints [21].

In our study, significant sexual dimorphism was reported by both examiners. Type I pattern was commonest among females whereas Type IV pattern was most frequent in males. This is consistent with the studies conducted by Sharma (2009)[3], Vahanwala et al (2005) [16] , Rohit (2011)[17] and Dongarwar et al(2013)[22]

Vahanwala et al (2005) [16] observed that Type I, I' and II patterns were dominant in females as compared to Type III and IV and V patterns in males. Sharma (2009)[3] and Rohit (2011)[17] also noted similar findings in their studies. Our results are consistent with their studies.

In another study by Vahanwala and Parekh[15], it was shown that all four quadrants with the same type of lip prints were predominantly seen in females while males showed the presence of different pattern in a single individual.

Overall examiner 1 and examiner2 had the predictive accuracy of 89% and 91% respectively in correct sex determination in the present study. Comparable findings have been observed by other researchers. Sharma(2009) [3] identified the sex of 87.5% subjects correctly in a study group of 40 subjects while accuracy of prediction was 85% for Dongarwar et al(2013)[22] . However, Rohit (2011)[17] had the predictive accuracy of 95% in identification of sex based solely on lip print patterns.

The predictive accuracy of sex determination was 86% and 88% for males and 92% and 94% for females by examiner 1 and examiner2 respectively. This is in accordance with the study by Sharma (2009)[3] whose accuracy of prediction was 88% in males and 90% among females. Moreover, Rohit (2011)[17] recognized 90% males and 96% females as compared to 92% males and 95% females by Gondivkar (2009)[19] in his study.

In our study the percentage of predictive accuracy was more for females than males also seen in other studies. This was due to the reason that variant types in all quadrants in males made decision making difficult for the researchers.

## CONCLUSION

If the sex of the individual is known, it is easy to exclude a large number of suspects from the investigation. The present study is able to convey that lip prints behold the potential of determination of sex of the individual. Though the result obtained by the present study does not prove to be an accurate method nevertheless it does seem to

promise to go one step closer to the truth. Lip prints thus hold potential promise as a supplementary tool along with the other methods for identification of sex of an individual.

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