ORIGINAL ARTICLE

Cheiloscopy for sex determination

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Abstract

Background: Identification of an individual is a pre-requisite for certification of death and for personal, social and legal reasons. The study of lip-prints (cheiloscopy) was thought of as a method of identification of a person. It is safe to assume that cheiloscopy, in its present stage of development, has become a means of criminalistic identification dealing with lip-prints. **Objective:** The objective of the study was to check for any peculiar lip patterns in relation to the sex of the individual and determine the most common lip patterns in the Indian population. **Materials and Methods:** This study was conducted on 140 subjects, which included 70 males and 70 females, in the age group of 0-70 years. After applying lip stick evenly, the lip-print of each subject was obtained on a simple bond paper by researcher number 1. The lip-print was then analyzed and interpreted by researcher number 2 to determine the sex of individuals. **Results:** We found that 67 of the actual 70 lip-prints of females were correctly identified and 65 of the 70 males were correctly diagnosed as males. Type C (47.14%) was the most commonly occurring trend in females whereas Type B (70%) was the most commonly occurring trend in males. **Conclusion:** Along with other traditional methods, cheiloscopy can also serve as very important tool in the identification of a person based on the characteristic arrangement of lines appearing on the red part of the lips.

Key words: Cheiloscopy, sex determination, lip-prints

Introduction

One of the challenges faced by man in earlier days was to establish the identity of an individual. The concept of "identity" is a set of physical characteristics, functional or psychic, normal or pathological- that define an individual. Identification of humans is a prerequisite for personal, social and legal reasons.[1] Traditional methods of personal identification include anthropometry, dactyloscopy, DNA fingertyping, sex determination, estimation of age, measurement of height, post-mortem reports and differentiation by blood groups. These methods have been proved to be successful in many cases.[2,3]

Civil cases range from single malpractice suits to mass disaster insurance claims. Criminal cases involve identification of both murder victims and suspects.[4] Keiser-Nielson described forensic odontology as "the proper handling and examination of dental evidence in the interest of justice, so that the dental findings may be properly presented and evaluated". Fingerprints and dental record comparison are the most commonly used scientific methods of forensic identification.[1] Findings in teeth have been extremely useful in this field; since the tooth, the hardest tissue in the human body, is extremely resistant to physical and chemical agents.[2]

The study of lip prints is called cheiloscopy. Cheiloscopy was differently described by persons carrying out research. It was thought of as a method of identification of a person based on the characteristic arrangement of lines appearing on the red part of the lips. It is safe, however, to assume that cheiloscopy, in its present stage of development, has surpassed the limits of a method and has become a means of criminalistic identification dealing with lip prints.[5]

Lip prints are unique[6] and do not change during the life of a person. It has been verified that lip prints recover after undergoing alterations like minor trauma, inflammation [2] and diseases like herpes. The form of the furrows does not vary with environmental factors. However, major trauma to the lips may lead to scarring, pathosis and the surgical treatment rendered to correct the pathosis may affect the size and shape of the lip, thereby, altering the

pattern and morphology of grooves.[7] The lip prints of parents and children and those of siblings have shown some similarities. It has also been suggested that variations in patterns among males and females could help in sex determination.[8]

The most characteristic groove patterns of human lips could be recorded in a cross line diagram (similar to traditional dental charting of the quadrants), the lip-print diagram[3] as given below:

Right upper lip I quadrant	Left upper lip II quadrant
Right lower lip IV quadrant	Left lower lip III quadrant

Lip prints were classified using the classification proposed by Suzuki K. and Tsuchihashi Y. in 1970 also known as Tsuchihashi's classification. They classified the natural lip marks/fissures in four types as follows[2] [Figure 1]:

Type I : Vertical, comprising of complete (end to end) longitudinal fissures/patterns.
Type I ' : Incomplete longitudinal fissures
Type II : Branching Y shaped pattern.
Type III : Criss-cross pattern
Type IV : Reticular, typical chequered pattern, fence like.

This is the most widely used classification used in literature. It was found to have a clear description of nearly all of the commonly encountered lip patterns and was easy to interpret. Its resemblance to the dental formula was also familiar to the forensic dentist.[2,3]

A study by Vahanwala-Parekh, suggests that certain pattern trends were prevalent in either sex.[3]

Lip-pattern type	**Site prediliction**	**Gender prediliction**
Type I & Type I'	1st quadrant (Right upper lip)	Female
Type II	2nd quadrant (Left upper lip)	Male
Type III	Never occurs in lower lip	If so, only in male
Varied patterns	In all quadrants	Male
Similar patterns	In all quadrants	Female

With the current status of cheiloscopy in mind, this study was carried out to study the peculiar lip patterns, its role as indicator of sex of an individual and to identify the most common lip patterns in study population.

Materials and Methods

This study was carried out in the Department of Oral Diagnosis, Medicine & Radiology, Sharad Pawar Dental College and Hospital, Sawangi, Wardha, Maharashtra after approval of local ethical committee, DMIMS, Sawangi, Wardha.

All the participants were briefed about the purpose of the study and the written informed consent was obtained from each of the participant. This study was conducted on 140 subjects, which included 70 males and 70 females, in the age group of 0-70 years. All the subjects were grouped separately in seven sets, of 10 males and 10 females each according to the age groups like A- 0 to 10, B- 11 to 20, C- 21to 30, D- 31 to 40, E- 41 to 50, F- 51 to 60, and G- 61 to 70. Each subject was given a code number for e.g, A-1, B-1, C-3, to hide the actual sex from the analyzer. Care was taken to select individuals without any lesion, whether active or passive on the lips. Individuals with known hypersensitivity to lip-prints were excluded from the study. Lipstick was applied by researcher no.1 with a single stroke, evenly on the vermilion border. The subject was then asked to rub both the lips to spread the applied lipstick evenly. The set of lip-imprints were then obtained on a simple bond paper and they were coded based on the name and the sex of the individuals. To avoid bias, all the lip-prints were compiled, analyzed and interpreted by researcher no. 2 to determine the sex of individuals [Figures 2-5].

The data was compiled and analyzed with Chi-square test using Yate's correction and a *P*-value less than 0.05 was considered as significant.

Results

After interpretation of lip-print patterns, as per Vahanwala-Parekh,[3] sex determination was correctly diagnosed in 65 males and 67 females [Tables 1-3]. The most predominant pattern in the entire study population, taking both the upper and lower lips together, was Type II (28.59%). This was followed, in order, by Type III (27.89%), Type I (19.29%), Type I' (12.80%), Type IV (9.64%). In males, Type III (51.05%) lip pattern was predominantly reported whereas Type II (37.06%) lip pattern was commonly found in females [Figure 6]. All the four quadrants with the same type of lip pattern were predominantly seen in female subjects (10%) relative to males (2.85%). Male subjects showed presence of different lip patterns in a single individual (1.42%). Type B i.e, same lip pattern in three quadrants was the most commonly occurring trend in females (47.14%) as compared to males (25.71%). Type C i.e, same lip pattern in two quadrants was the most commonly occurring trend in males (70%) relative to females (42.85%) [Figure 7]. In the present study, the participants in the age range of 0-70 years were selected to rule out any chance of error in the correct

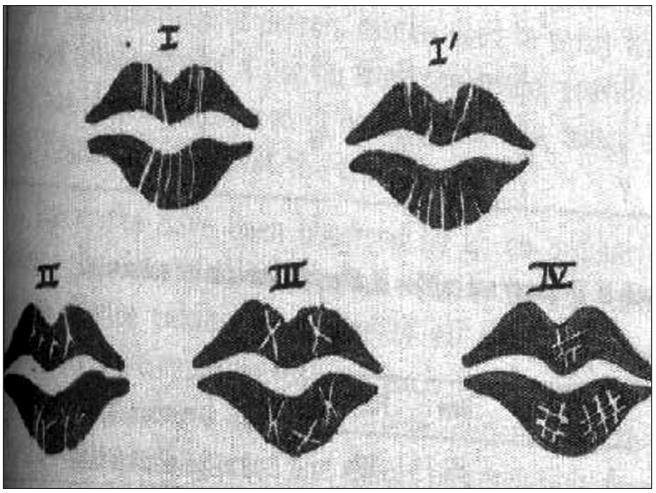

Figure 1: Suzuki's classification

Figure 2: Photograph of lips of a male subject

Figure 3: Photograph of a lip print of the male subject in Figure 2

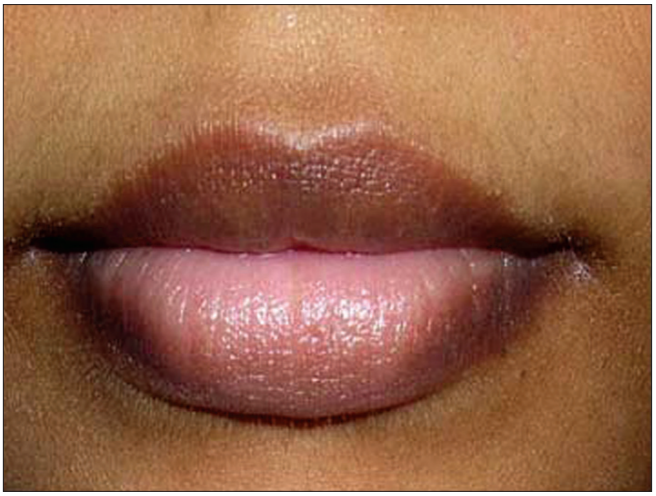

Figure 4: Photograph of the lips of a female subject

Figure 5: Photograph of a lip print of the female subject in Figure 4

Table 1: Accuracy of gender determination among the 70 females

Age group	Diagnosed correct	Diagnosed wrong	*P*-value
0-10	10	-	
11-20	9	1	$r^2=4.17$
21-30	9	1	$P=0.65$
31-40	10	-	
41-50	10	-	
51-60	10	-	
61-70	9	1	

Table 2: Accuracy of gender determination among 70 males

Age group	Diagnosed correct	Diagnosed wrong	*P*-value
0-10	10	-	
11-20	10	-	$r^2=2.15$
21-30	9	1	$P=0.95$
31-40	9	1	
41-50	9	1	
51-60	9	1	
61-70	9	1	

interpretation of sex of an individual related to specific age. We failed to interpret the sex of three females, each from age group of second, third and seventh decade as well as

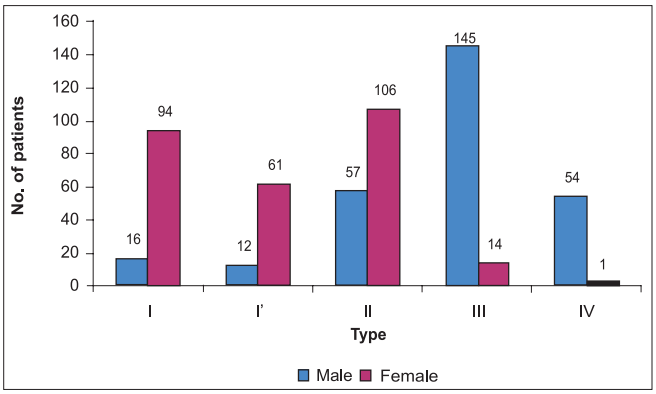

Figure 6: Common lip pattern in males and females

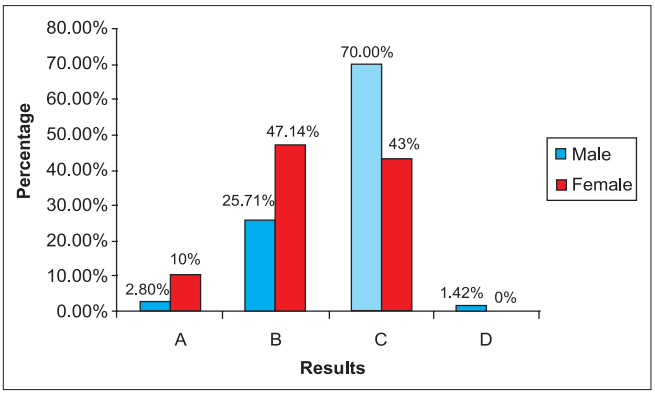

Figure 7: Repetition of patterns in different quadrants in same patient. (A = all quadrants same; B = three quadrants similar; C = two quadrants similar; D = all quadrants different)

Table 3: Overall accuracy of cheiloscopy in gender determination

Participants	Diagnosed correct	Diagnosed wrong
Males	65	05
Females	67	03
Total	132	08

$r^2 = 1.19$; $P > 0.05$

error was reported in correct interpretation of the sex of five males, each from age group of third to seventh decade.

Discussion

Human identification is a mainstay of civilization, and the identification of unknown individuals has always been of paramount importance to society.[9] Identification of any individual - living or dead is based on the theory that all individuals are unique. When an unidentified body or a trace is found it is assumed that it could be anybody. By classifying the individuals into groups (e.g. age, sex, race, height), the identification possibilities are narrowed. The more unique the characteristic, the smaller the group becomes. As more unique characteristics are noted, the comparison group becomes smaller until it reaches unity.[10]

The positive identification of living or deceased persons using the unique traits and characteristics of the teeth and jaws is a corner stone of forensic science.[11] A series of forensic odontological studies on the morphology of the lips and the pattern produced when they are impressed onto a variety of surfaces forms a worthy additional weapon for personal identification.[2] The red part of the lips together with an individual structure of lines may constitute a source of circumstantial evidence.

This study was carried out to classify and study the common lip-patterns and their variations in the study population, and to evaluate the differences between the sexes.

The lips which were studied were only those which had no inflammatory disease, trauma, malformation, deformity or scars. However, these abnormalities themselves are identification marks. It is difficult to decide the pattern of the lip prints when inflammation is present in the lip. It has been observed that, after healing, the lip reassumes its own pattern in the healthy condition; this fact in itself indicates the permanence of the lip print.[2]

In general, because the lip print is on the zone of transition of the lips, which are extremely mobile, it might differ in appearance according to the pressure, direction and method used while taking the impression, frequently being mistaken for another person. Basically, however, type I never appears like type II. Therefore, the classification of the lip-prints is valuable in reducing the number of items to be compared, and the discernment of identity should be made, as in the case of fingerprints, by finding characteristic points to establish the diagnosis.[2]

To establish the identity between evidential and comparative trace, the common properties are to be determined. The determination of nine individual properties is necessary worldwide to establish the identity. A catalogue of 23 types of individual properties had been prepared by Kasprzak J.[5] He stated that an average of 1145.5 individual properties could be established for one lip print trace whereas in one trace of finger print only 100 individual properties could be differentiated. Lip print identification methodology, although seldom used, is very similar to finger print comparison.[5]

Recent studies[12,13] also point to other possibilities namely, DNA detection in latent lip-prints, where some researchers are trying to relate characteristic lip patterns with a person's gender.[14] One must also consider the possibility of post-mortem changes of lip prints from cadavers with various causes of death. Utsuno *et al.*[15] have studied these changes and concluded that

a satisfactory identification rate could be achieved. It should also be pointed out that only in very limited circumstances, ante-mortem data referring to lip prints, is available which obviously impairs a comparative study where necro-identification is concerned. The main feature for dental identification is the existence of ante-mortem data[16-18] which cannot be expected in cheiloscopy. Therefore, the only use of cheiloscopy will be to relate lip prints to the lips that produced them.

Evidences such as photographs, cigarette butts, drinking glasses, cups, letters, window panes and other items that could bear lip prints should be closely examined. A trace of this kind carries a huge amount of information which can be used in the reconstruction of the events, establishing versions, checking them and identifying suspects. A lip print at the scene of crime can be basis for conclusion as to the character of the event, the number and sex of the people involved, cosmetics used, habits, occupational trials and the pathological changes of the lips themselves. The classification and observation of patterns in the population have resulted in some useful data.[5] Although lip prints have previously been used in a court of law, its use is not consensual. The FBI has used this kind of evidence only in a single case in order to obtain a positive identification.

Conclusion

Despite the fact that identification of an individual by lip prints appears to be accepted in some places, this procedure requires further studies with larger sample size. The uniqueness of lip prints need to be confirmed and accepted. A standard and uniform procedure has to be developed for the collection, development and recording of lip prints and the ensuing comparison. Until then identification by lip prints will not stand up to rigorous interrogation in court.

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