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Accuracy of cheiloscopy as a tool for sex determination – A study of lip prints

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Abstract

Aim: Cheiloscopy has been a sought after gismo in forensic odontology due to its easy application in evaluation of crimes and the criminals and its unique print of every individual. The lip patterns can be used for gender discrimination, thus the present study evaluated the efficacy of lip patterns in determining the same.

Materials and method: Lip prints from 150 subjects (75 males and 75 females) were obtained using lipstick and pressing a strip of cellophane on the lips of the participant. The obtained prints were then transferred, scanned and analysed using Adobe photoshop. The patterns of lips were documented and chi-square test was done to obtain the results.

Results: The analysis of the obtained samples predicted 72 females and 78 males. The study showed correct diagnosis for 90.8% of the actual number of male subjects and 88% of actual number of female subjects.

Conclusion: The results concluded that cheiloscopy could be an important investigation in assessing the gender of an individual, also the lip patterns for males and females differs considerably, thus making the study of lip patterns more effective.

Keywords: cheiloscopy, lip prints, gender, forensic odontology

Introduction

The science of cheiloscopy has led to revelation of another unique identifying feature of humans and is considered an important tool in forensic odontology. Lip prints are identifiable in intrauterine life and remain the same throughout the life of an individual; despite being damaged in an injury, they heal in the same manner.[1,2] The salivary and sebaceous glands present at the vermilion border of the lips help in retention of moisture which in turn helps in formation of latent lip pattern and can be examined using various reagents for the same.[3] The pattern produced by lip grooves on mechanical surface is termed lip print.[4] The grooves on the lips have been studied and analysed; they are termed as Sulci Labiorum. The lip prints exhibiting these groves are known as Figura linearum labiorum rubrorum.[5] The lip groves have been classified on the basis of these grooves and can play an essential role in determination of sex, identification of criminal or post mortem analysis. The evaluation of lip anatomy has helped in determination of sex and race of the individuals. Suzuki and Tsuchihashi (1970) classified the lip prints into 6 categories[6], while Vahanwala et al[7] associated this classification and described patterns which can be helpful in sex determination using lip prints. Vahanwala explained that Type I, Type I' and Type II are predominant in females while the others including Type III, IV and V is present on males. The history of cheiloscopy is rich with evidence suggesting reproduction of the lip prints using various means can be really useful. Thus, the present study was carried out to classify lip patterns and document common patterns and their variations in the population under investigation, to evaluate any differences between the sexes to investigate the potential role of lip prints in person identification.

Materials and Method

A total of 150 individuals (75-males and 75 females) of rural and urban localities of Chhattisgarh, India, with age range of 06 years to 37 years who reported to the OPD were chosen for the study. The individuals selected did not have any active or passive lesion on the lips. The individuals giving a history of hypersensitivity to lipsticks or any it's product were not included in the study. All the participants were intimated about of the study and their lip prints were obtained after they have given their consent. For participants under the age of 18 years, the consent was taken from either of the parents. Ethical clearance was obtained from the Institutional ethical committee. The materials used were dark red colored lipstick of Lakme (Lakmé enrich lip color classics), lipstick applicator brush (Vega), A-4 bond paper (Bilt Image copier), Cellophane strip from Magic tape of width 45mm (Wondertape), scanner (HP desk jet F2235), Adobe photoshop 7.0 software (Adobe Systems Inc., USA). Method of collection: The subject was asked to slightly open the mask and lipstick was applied evenly using the applicator brush in a single motion. The lipstick was applied completely and uniformly starting at the midline and moving laterally. The subject was asked to gently rub his/her lips together to spread the lipstick evenly. The lipstick was allowed to dry for about 2 minutes after which lip prints were taken. A strip of 10 cm long cellophane tape was cut with scissors. The subject was asked to open the mouth slightly, and to keep the mouth stationary during the procedure. The glued portion of the cellophane tape was applied on the lips in rest position starting with the central portion first and then extending towards both the corners. It was held in place, applying gentle and even pressure for a few

seconds. Then the tape was carefully lifted from the lip, from one end to the other, avoiding any smudging of the print. The strip of cellophane was stuck on to a piece of white bond paper. This served as a permanent record. The subject's code number was written on the top to serve as a record. It was coded, keeping in account the age & sex of respective individuals. The coded lip prints were given to the analyser who was unaware of the sex of the individual. Method for analysis of lip prints: The lip prints of each individual were scanned using an image scanner set at a resolution of 600 ppi. They were stored as JPEG files. The most legible prints of both lips taken together on cellophane tape were cropped and vertical lines drawn to divide the left and the right sides using Adobe® Photoshop® 7.0 software. The lip prints were classified using the classification given by Suzuki and Tsuchihashi. The determination of the pattern in each segment of the lip was based on the numerical superiority of properties of the lines on the fragment. In cases where there were two or more dominant patterns were noted, less dominant pattern were also taken alongside the most dominant pattern. The results were then tabulated. The data was compiled to find out the number of correct and wrong diagnosis and analysed with Chi – square test. The frequency of each type of lip print was tabulated and the percentage of each type was calculated. The data was also compiled accordance to the predominant type of pattern in each sex. This was again analysed by chi –square test to find the significance of different types of patterns in different sexes. The predominance of a particular type of pattern in each of the four quadrants or three quadrants or two quadrants or none in both males and females were compiled separately. The accuracy of cheiloscopy in sex determination is to be proven by the outcomes of the tests.

Results

The age of the male candidates ranged from 07-36years with a mean age of 18.43 and standard deviation of 5.089years. The age of the female subjects were in the range 06-34 years with a mean age of 19.64 years and standard deviation of 4.06 years. Thus the mean age of all the subjects was 19.03 years with the standard deviation of 4.163 years. The analysis of the lip prints estimated 72 females and 78 males. On comparison of the actual patients' data, it was revealed that 68 males from the 78 subjects diagnosed as males and 66 females from the 72 diagnosed as females were correct i.e. 90.8% of the actual number of male subjects and 88% of actual number of female subjects were correctly diagnosed. The correct and the wrong diagnoses were compared using the chi-square test (table 1 and 2). The percentage of individual patterns have shown type I' was maximum in females while males showed predominant type II pattern (table 3)

Discussion

The use of lip prints in sex determination could be of great benefits in crime scenes. The use of cellophane sheet to transfer the lip prints on a paper help in retaining the originality of the prints while avoiding any discrepancy. The edges of the lips contain sebaceous glands along with sweat glands in between. The secretions of these glands enable the development of latent lip prints. The latent lip prints can be attained up to 30 days after being produced. For identification the entire lip prints are important which not only includes mucosal area of lips covered with wrinkles and grooves forming lip prints (Klein zone).[8] The present study consisted of 150 subjects with 75 males and 75 females. The lip prints were diagnosed incorrectly were only 7 for males and 9 of females. When the chi-square test had been applied, χ^2 was calculated as 92.82 and p value was

<0.01, thus it can be stated that the number of diagnosed cases were significantly higher than the number of incorrectly diagnosed cases. The most predominant patterns in females were found to be I & I' (74.33%) while the least common pattern observed was type III. The type III pattern if present was observed only in upper lip. Another significant observation amongst the females in the study group was that type II was not present in the second quadrant, even though it is the 3rd most prevelant pattern in females. Type II was present in 17.33% of the females. The above results are in accordance to the studies of Vahanwala et al.[7] The type III pattern was found in the third quadrant exclusively in males in greatest number of cases as compared to the other patterns while none of the female subjects showed this pattern in the lower right quadrant. This again is in compliance to the study by Vahanwala et al[9] and Kaul et al.[8] Type II was the most predominant pattern in the 2nd quadrant. The type III pattern was found in the third quadrant exclusively in males in greatest number of cases as compared to the other patterns while none of the female subjects showed this pattern in the lower right quadrant. The study revealed that in male subjects the least common of all the patterns was Type V found only in 3.33% of the cases. This was in accordance to the study by Saraswathi et al[10] and Amith et al[11] but contradictory results were found in study done by Augustine et al where Type IV was common in females and Type I in males.[12] In 4.166% of the total study subjects the pattern was undetermined as it could not be categorized into the other 4 pattern types and hence it was considered to be type V. These undetermined types of pattern were noticed in 3.33% males and 3.33% females. Thus if we cannot categorize a pattern into the types established by Tsuchihashi it has been proven to be a diagnostic dilemma for sex determination by implying the proven methods of study in cheiloscopy. Thus type V was one of the drawbacks of the method.

Another parameter considered in the study was the similarity of pattern distribution in between the 4 quadrants. Similarity in patterns of all four quadrants was denoted as group A which was found in 30.55% of the cases in females; while none of the males show such pattern. This observation was in accordance to the results of both Vahanwala et al[7] and Gondivkar et al[2]; who had stated that similarity in pattern in all 4 quadrants is a feature in females. Similarity of pattern in three quadrants which has been denoted as type B are found in 40.72% females and 11.11% males. While similarity in pattern in 2 quadrants which has been denoted as type C is the most predominant type in males as it has been observed in 55.55.% males and 26.38% females. Both these results that have been deduced from our study were agreeable with the results of Gondivkar et al[2] Next dissimilar pattern in all quadrants denoted as type D was observed in 41.66% males and 2.77% females.

Conclusion

The present study assessed the importance of cheiloscopy in sex determination. Within the limitations, the study has shown promising results in accuracy of sex determination by taking lip prints into consideration. Type I pattern was most common in female population while Type III was dominant in males. Further studies are required to associate the patterns along with thickness or shape of the lips along with lip prints for exact identification and sex determination.

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Legend Table and Figure

Table 1: Analysing chi-square of right and wrong diagnosis

	Male	Female	Total	χ^2	P
Correct diagnosis	68	66	134	92.82	<0.01
Wrong diagnosis	07	09	16		

Table 2: Chi –square test for males and females

	Males	Females	Total
Chi-Square	.000[a]	.000[a]	.333[b]
Df	2	2	1
Asymp. Sig.	1.000	1.000	.564

Table 3: Percentage of different patterns in both sexes

	% Male	% Female	% Total
I	23	34.66	28.83
I'	20	39.66	29.83
II	26.66	17.33	21.995
III	16.33	0.66	8.495
IV	10.66	4.33	7.495

Figure 1: Analysis of lip prints are done in Adobe Photoshop