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Cheiloscopy and Gender: The Battle between the Changing Trends

[1]Dr. Sayeeda Sadaf Hashmath, Post graduate student, Department of Oral and Maxillofacial Pathology, Sri Sai College of Dental Surgery, Vikarabad, Telangana

[2]Dr. Syed Afroz Ahmed, Head of the Department and Professor, Department of Oral and Maxillofacial Pathology, Sri Sai College of Dental Surgery, Vikarabad, Telangana

[3]Dr. Charu Suri, Professor, Department of Oral and Maxillofacial Pathology, Sri Sai College of Dental Surgery, Vikarabad, Telangana

[4]Dr. Pyata Vamshi Krishna, Postgraduate student, Department of Oral and Maxillofacial Pathology, Sri Sai College of Dental Surgery, Vikarabad, Telangana

Corresponding author: Dr. Sayeeda Sadaf Hashmath, Post graduate student, Department of Oral and Maxillofacial Pathology, Sri Sai College of Dental Surgery, Vikarabad, Telangana

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Abstract

Introduction: Identification is a matter of paramount importance in any crime investigation. Even though DNA and fingerprints are the time-tested methods, these evidences are not always available at the investigation sites. In such circumstances, it is necessary to apply different and less-known techniques. A new area of investigation in the detection of crime is the use of wrinkles on the lips. The imprints produced by the lip are termed as "lip print". These are less commonly used in forensic studies but have significant value in crime investigations. The examination of lip print is called as " cheiloscopy".

Aim: To determine the gender by comparing the conventional and digital methods of cheiloscopy.

Materials and Methods: A total of 90 individuals (45 females and 45 males) were included in this study. The latent lip-print of each subject will be obtained on a simple bond paper. A natural dye, vermilion, was added on the latent lip prints till the lip prints becomes visible. The lip prints was then analyzed for gender with magnifying lens. Same lip prints was scanned, and Adobe Photoshop software 7.0 was used to determine the gender of the subjects.

Results and Conclusion: In conventional method, 21 out of 45 females and 40 out of 45 males were correctly

identified. In the digital method, 44 out of 45 females and 42 out of 45 males were identified correctly. In addition, type 1a lip print was predominant in females where as type 2 lip print was predominant in males. Hence, chieloscopy is godsend to forensic dentistry.

Keywords: Chieloscopy, Conventional, Digital, Gender Estimation.

Introduction

"Identity" is a set of physical characteristics, functional or psychic, normal or pathological, that defines an individual. With the ever-increasing demands placed upon law enforcement to provide sufficient physical evidence linking a perpetrator to a crime, it makes sense to utilize any type of physical characteristic to identify a suspect of an offense [1.] 1 Various methods have been identified which aids in identification of an individual such as DNA profiling, dental records, anthropometry, age estimation and sex determination etc.[2] Among all, the least invasive and cost-effective procedure is the study of lip prints and fingerprints. "Lip prints are defined as the normal lines and fissures present in the form of wrinkles and grooves that are located in the transition zone of the human lip, between the inner labial mucosa and the outer skin, the examination of which is referred as cheiloscopy.[1]

Identification of lip prints goes back in 1902 when Fischer, an anthropologist described them as the furrows on red part of human lips. Later in 1932, lip prints were recommended for personal identification and criminal investigations by famous Edmond Locard, a French criminologists.[1] In 1970, Suzuki K. and Tsuchihashi Y. studied lip print patterns in 107 families and gave a classification to identify different lip print patterns. It has been observed that lip prints can be identified as early as sixth week of intrauterine life and they do not change during the life of an individual. Even after trauma, inflammation and diseases like herpes they recover and can be identified without any defect. Like finger prints, lipprints are unique to ever individual.[2]

This study aim to determine the gender by comparing the conventional and digital methods of cheiloscopy.

Materials and Methods

A total of 90 individuals were included in this study. The latent lip-print of each subject will be obtained on a simple bond paper. The vermilion dye (sindoor) which is a natural dye, was added on the latent lip prints till the lip prints became visible. The lip prints was then analyzed for gender with magnifying lens. Same lip prints were scanned, and Adobe Photoshop software 7.0 was used to determine the gender of the subjects. Gender was estimated using Suzuki tsuchihashi (1970) classification for lip prints in both the methods.

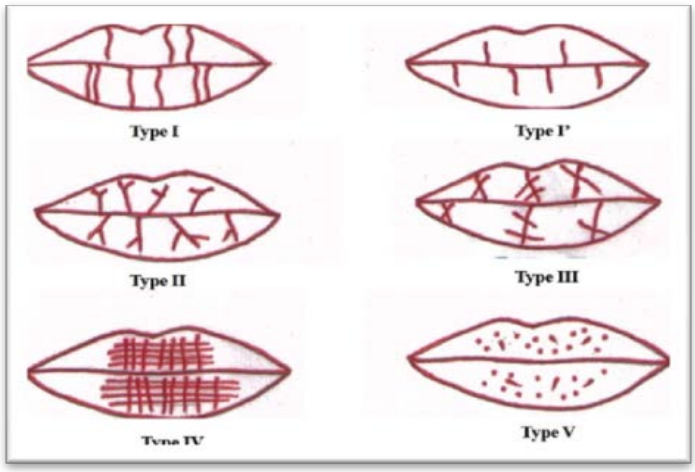


Figure 1: Suzuki tsuchihashi classification of lip prints.

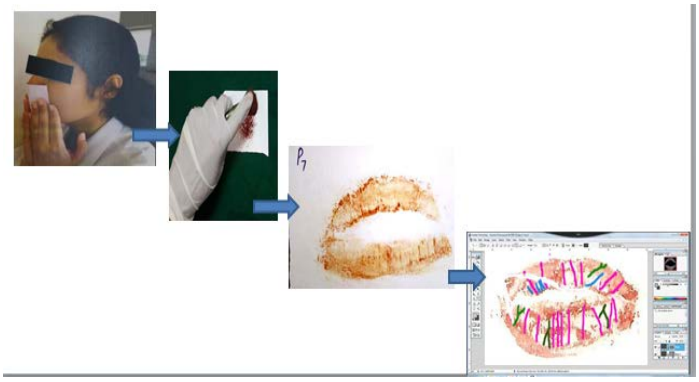


Figure 2: procedure of taking lip prints

Statistical Analysis: Data was summarized by percentages for categorical data. The comparison between digital and conventional procedures for the parameter type of lip prints and Gender was done by Chi-square test. All p-values less than 0.05 were considered as statistically significant.

Statistical Software: IBM SPSS statistics 22.0 Version for statistical analysis and M.S Office 2015 for graphs and tables.

Results and Observations

The study included 90 individuals which comprised of 45 males and 45 females. In the present study, it was found that, the most predominant lip print among females was type 1A in both the methods. Out of 45 females in the study group, 21 of them in conventional and 30 of them in the digital method have proved to have type 1A lip prints. Furthermore, in the present study, the most predominant lip print among males was type 2 in both the methods. The study included 45 males too out of which 29 males in conventional method and 22 males in digital method have demonstrated type 2 lip prints in them. Further, the type 1A lip print was most accurately determined in digital method whereas, type 2 lip print was most accurately determined in the conventional method. The results were statistically different among males and females in both the methods. P value was >0.05 in both the methods **(Table 1 and 2).**

Further, significant changes were observed between Digital and Conventional procedures while determining the type of lip prints. Type 1A is predominant identified in digital (44.44%) and Type 2 in conventional (42.22%). P value was >0.05, it is 0.007. **(Table 3)**

In the conventional method, 59 individuals were estimated to be males and 31 subjects were estimated to be females. Out of 59 estimated males, the gender of 40 individuals was correctly identified. Likewise in the female category, the gender of 21 females out of 31 estimated females was correctly recognized.(**Table 4, figure 1).** In the digital method, out of total 90 subjects, 44 individuals were estimated to be males and 46 subjects were estimated to be females. Out of 44 estimated males, the gender of 42 individuals was correctly identified. Similarly, in the female group, the gender of 44 females out of 46 estimated females was correctly determined.(**Table 5, figure 2).**

In the conventional method, a significant difference between known and estimated gender was witnessed and accuracy was 68.8% for both the genders.in the present study, conventional method did not seem to be very accurate in determining the gender**.(Table 4).** Where as in digital method, there was no significant changes between known and estimated gender and the known and estimated gender is almost similar. Pvalue is 0.88 and accuracy in 97.7% **(table 5).** Hence, on comparison, there is statistically significant changes between conventional and digital method for estimating gender. More number of males were correctly identified in the conventional method and greater number of females where correctly identified using digital method. Digital method proved to be more accurate than conventional metho in this study for correct identification of gender. **(Table 6, figure 3).**

Figures and Tables

Table-1: The comparison of Type of lip prints between Males and Females in Digital group.

Type of lip prints	Male n (%)	Female n (%)	Chi-square value	P-value
1A	10 (22.22)	30 (66.67)	25.693	0.000 Significant
1B	9 (20.00)	10 (22.22)		
2	22 (48.89)	3 (6.67)		
3	0 (0.00)	0 (0.00)		
4	1 (2.22)	0 (0.00)		
5	3 (6.67)	2 (4.44)		
Total	45 (100.00)	45 (100.00)		

Statistical Analysis: Chi-square test. If P<0.05: Statistically significant.

Table 2: The comparison of Type of lip prints between Males and Females in Conventional group.

Type of lip prints	Male n(%)	Female n(%)	Chi-square value	P-value
1A	4 (8.89)	21 (46.67)	22.686	0.000 Significant
1B	5 (11.11)	5 (11.11)		
2	29 (64.44)	9 (20.00)		
3	2 (4.44)	3 (6.67)		
4	1 (2.22)	1 (2.22)		
5	4 (8.89)	6 (13.33)		
Total	45 (100.00)	45 (100.00)		

Statistical Analysis: Chi-square test. If P<0.05: Statistically significant.

Table 3: The comparison between digital and conventional procedures for the parameter type of lip prints

Type of lip prints	Digital n (%)	Conventional n (%)	Chi-square value	P-value
1A	40 (44.44)	25 (27.78)	15.937	0.007 Significant
1B	19 (21.11)	10 (11.11)		
2	25 (27.78)	38 (42.22)		
3	0 (0.00)	5 (5.56)		
4	1 (1.11)	2 (2.22)		
5	5 (5.56)	10 (11.11)		
Total	90 (100.00)	90 (100.00)		

Statistical Analysis: Chi-square test. If P<0.05: Statistically significant

Table 4: the comparison between known and estimated sex for the procedure conventional

Sex	Known n(%)	Estimated n (%)	Chi-square value	P value	Accuracy
Male	45 (50.00)	59 (65.56)	4.464	0.035 Significant	68.89%
Female	45 (50.00)	31 (34.44)			68.89%
Total	90 (100.00)	90 (100.00)			68.89%

Statistical Analysis: Chi-square test. If P<0.05: Statistically significant.

Figure 1: The cluster bar diagram for the comparison between known and estimated sex for the procedures conventional

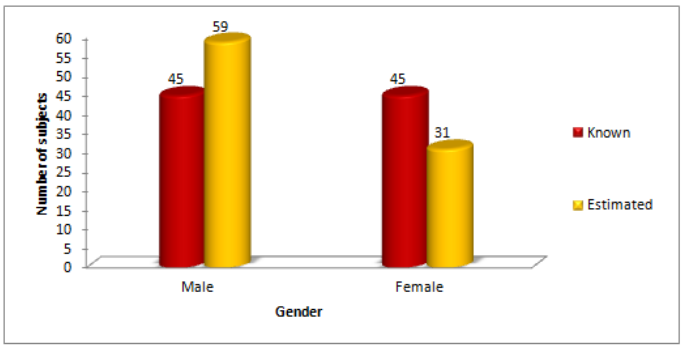


Table 5: The comparison between known and estimated sex for the procedure digital

Sex	Known n(%)	Estimated n(%)	Chi-square value	P value	Accuracy
Male	45 (50.00)	44 (48.89)	0.022	0.881 Not significant	97.78%
Female	45 (50.00)	46 (51.11)			97.78%
Total	90 (100.00)	90 (100.00)			97.78%

Statistical Analysis: Chi-square test. If P<0.05: Statistically significant.

Figure 2: The grouped bar diagram for the comparison between known and estimated sex for the procedure digital

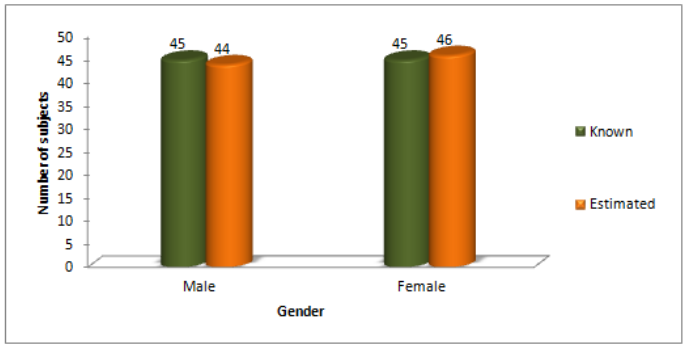
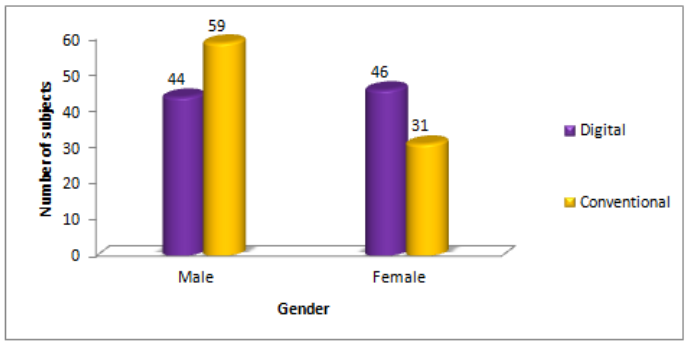


Table 6: The comparison between digital and conventional procedures for the parameter estimated sex

Estimated sex	Digital n(%)	Conventional n(%)	Chi-square value	P-value
Male	44 (48.89)	59 (65.56)	5.107	0.024 Significant
Female	46 (51.11)	31 (34.44)		
Total	90 (100.00)	90 (100.00)		

Statistical Analysis: Chi-square test. If P<0.05: Statistically significant.

Figure 3: The grouped bar diagram for the comparison between digital and conventional procedures for the parameter estimated sex.



Discussion

Identification of lip prints goes back in 1902 when Fischer, an anthropologist described them as the furrows on red part of human lips. Later in 1932, lip prints were recommended for personal identification and criminal investigations by famous Edmond Locard, a French criminologists. In 1970, Suzuki K. and Tsuchihashi Y. studied lip print patterns in 107 families and gave a classification to identify different lip print patterns. Lip prints are normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of human lip, between the inner labial mucosa and outer skin, examination of which is known as cheiloscopy. It has been observed that lip prints can be identified as early as sixth week of intrauterine life and they do not change during the life of an individual. Just like finger prints, lip prints are also unique to an individual and thus may form a potential source for positive identification. Even after trauma, inflammation and diseases like herpes they recover and can be identified without any defect. [2] This unique property of lip prints make it possible to use it in determination of gender.

Singh NN, Brave VR, Khanna S in 2010 conducted a study on 45 individuals to compare the efficacy of sudan black, vermilion, and indigo in developing visible and latent lip prints made on bone china cup, satin fabric, and cotton fabric. Vermilion dye gave better results amoung the three although the differences amoung three was statistically insignificant.[3] Similarly, in the **present study** , latent lip prints are developed using vermilion dye to determine the gender of the 90 (45 female and 45 male) individuals. Suzuki and Tsuchihashi's classification for lip print was followed for interpretation.

In the current research, conventional and digital method of cheiloscopy were compared to estimate the gender. In conventional method, 21 out of 45 females and 40 out of 45 males were correctly identified. In the digital method, 44 out of 45 females and 42 out of 45 males were identified correctly. In addition, type 1a lip print was predominant in females where as type 2 lip print was predominant in males. The predominance of type 1A lip print in females is in accordance with a study conducted by **Sharma et al** on 40 (20 males and 20 females) individuals to demonstrate their gender via chieloscopy using convential method. The lip prints where recorded using a lipstick and cellophane tape for gender estimation. 18 females and 17 males were correctly identified. The most predominant lip print among females was found to be type 1a and type 1b where as in males type 3 and type 4 where commonly seen. [4]

The preponderance of type 2 lip prints observed in male subjects of this research work is in obedience with a study performed by **Shamaz M, S G Panchmal and V Hegde**

to estimate the gender of subjects above 12 years of age via chielocopy. Matte lipstick was used to record the lip prints for gender estimation. Type 2 lip pattern was common among males and type I among females.[5]

Augustine et al in 2014 conducted a study on lip prints for gender estimation through digital method. Type 3 was found to be the most common lip print among males and females. In the present study, digital method have been proved to be more efficient than conventional method in the analysis of gender. Crisp details are observed in the digital method and its easy to maintain the record of the sample due to lack of fear of distortion. Whereas the samples obtained by conventional method can be misplaced and get distorted over a period of time. [6]

Chieloscopy is godsend to forensic odontology in the recent times. Lip prints are are easy to obtain and efficient in providing the details which will aid in gender estimation. Though lip prints are quirky to an individual like fingerprints, advance studies are needed to address the uniqueness of lip grooves and also human characteristics like crusting of lips, post-surgical scars and pathologies like congenital lip pits, clefts, mucocele, ulceration, chelitis granulomatosa, etc.[7] More advanced studies need to be done to establish a standard protocol to obtain the lip prints.

Conclusions

Forensic dentistry plays a very significant role in establishing the identity of an individual. Chieloscopy is one of the most interesting antemortem techniques . By analyzing the available literature, we can conclude that cheiloscopy may be a reliable parameter of gender determination. If the sex of the individual is known, it is easy to short list the array of suspects with motive of the crime. The present study is able to convey that lip prints behold the potential of determination of the sex.

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