ORIGINAL ARTICLE

To Determine the Biometric Markers Like Cheiloscopic Patterns in Pakistani Population

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ABSTRACT

Objective: To determine the prevalence of cheiloscopic patterns in Pakistani population.

Study Design: Cross-sectional study.

Place and Duration of Study: The study was conducted at Post Graduate Medical Institute (PGMI), Lahore, Capital diagnostic Centre CDC Islamabad, HITEC Taxilla for a duration of 12 months from 1st September 2021 to 31st August 2022.

Materials and Methods: The lip prints of 320 males and females were taken by applying lip shades and then cellophane tapes (2 inches). They were transferred to an A4 sheet (white A4 ROCO Premium 80g copy papers) and then observed with magnifying hand lenses Deluxe magnifier (70mm diameter). The data was analyzed by IBM SPSS statistics 27.0. Chi square test was applied and a *p* value of ≤ 0.05 was considered statistically significant.

Results: The results showed differences in all individuals in both lip prints. The predominant lip pattern was type III, observed in 159 (99.4%) male participants while it was observed in all the female participants. Type I' observed in 37 (23.1%) female participants and IV are greater in females 160(100%) than males. Type II (was) greater in males 152 (95.0%) than females.

Conclusion: Lip prints are useful tool that can be used as biometric markers in dentistry and forensic odontology.

Key Words: *Cheiloscopy, Forensic Sciences, Lip Prints, Identification.*

Introduction

Outer surface of lip has many ridges and troughs leading to the formation of a distinctive format termed as lip prints. Evaluation of these prints is termed as cheiloscopy (cheilos refers to lips and skopien means to see).[1]

Establishing human identity is a complex process involving multiple domains. It relies on definitive strategies and techniques, including analyzing biometric data, precise administration and assessment of dental records, or any other forensic evidence.[2] Forensic dentistry focuses on post-mortem identification of an individual and identification of the culprit from evidences that may be left.[3] The patterns on lips can play a crucial role in determining a person's identity. They can be used to confirm whether an individual was present at a scene of misconduct, making lip prints valuable as biometric tools.[3] Lip print evaluation can be useful in predicting gender, ethnic groups, the kind of criminal violation, in addition to forecasting the number of people associated with the unlawful offence.[4]

Lip prints can be found on exteriors of fabric, crockery, cigarette butts, envelopes, and eating utensils, and is usually seen as visible (patent) or hidden (latent). Hidden lip prints can be developed by administering soluble lipid staining dyes, certain reagents, chromatic dyes, aluminum powder, cobalt oxide, nile red and magnetic powder. Conventional lipsticks generate a pattern of lip that can effortlessly be observed which is termed as visible lip print.[4] The creases and grooves on the lips begin to develop

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approximately on the 42nd day of gestation, and once fully formed, they remain permanent.[4] The patterns of lip have to be recorded within a day of expiration to avoid inaccurate findings that would change these prints from autopsy.[5] Lip prints can also be used in gender determination.[6]

Lip impressions were primarily studied in research where patterns without friction ridges were used to provide evidence. Lips also contain creases and wrinkles which are not present in finger prints and these can be categorized into multiple kinds for human certification.[7]

Any unlawful act requires recognition of both the affected and the accused.[8] Comparative interpretation is required in most cases of the chance imprints which are found on certain surfaces. The chances of these patterns developing from a region of the skin where friction ridges are absent have been observed. Odonatological, dactyloscopic and genetic records are possibly the most frequent strategies exercised in this aspect, enabling quick and safe recognition methods, as these cannot be always available sometimes it becomes inevitable to look for advance and novel methods.[9] The tendency of criminals to use deceptive methods during illegal activities has led to the use of lip prints as an additional tool in forensic dentistry.[10] Since the literature lacks data regarding the occurrence of patterns of lips in Pakistani population. This study aimed to determine the prevalence of lip prints in the Pakistani population to identify any gender-based differences.

Materials and Methods

This cross-sectional study was conducted in Oral Biology Department of Post Graduate Medical Institute, Lahore and Capital Diagnostic Center, Islamabad, from 1st September 2021 to 31st August 2022. The Ethical approval was taken from ethical review committee PGMI Lahore Registration no.00-30-A-2024, in accordance with the ethical norms of the relevant committee on human experimentation i.e. The Helsinki Declaration of 1975, as revised in 1983.The data was collected and analyzed by single observer who was a qualified dental surgeon. The sample size was calculated by the following formula keeping the power of study equal to 80% and level of significance equal to 5%.[11]

$$n = \frac{\left(Z_{1-\alpha/2}\sqrt{2\bar{p}(1-\bar{p})} + Z_{1-\beta}\sqrt{p_1(1-p_1)+p_2(1-p_2)}\right)^2}{(p_1-p_2)^2}$$

$$Where\ \bar{p} = \left(\frac{p_1+p_2}{2}\right)$$

(Sample Size determination in health studies version 2.0.21 WHO)

$P1$ is the anticipated proportions of lip pattern in male (Group A) = 45 %

$P2$ is the anticipated proportions of lip pattern in female (Group B) = 30%

$p1 - p2$ is the difference between proportions = 15%

$Z_{1-\beta}$ is the desired power of study = 80%

$Z_{1-\alpha/2}$ is the desired level of significance = 05%

The calculated sample size was 320. Both genders (male and female) with an age range of 20-50 years were included in the study. People without established occlusion, any history of lip trauma, lip pathology or lip surgery Individuals with known hypersensitivity to lipsticks were excluded. After obtaining informed consent lip prints were obtained from the 320 participants, 160 males and 160 females.

Cheiloscopic patterns were documented and it was allotted a serial number from 1 to 321. The patterns were recorded on a self-designed format. Demographic details of subjects which included age, gender and address and National identity Card number (NIC) were documented on the consent form. These patterns were recorded by using lip shades, ear buds, cellophane tape and scissors. Ear buds were taken and hydrated with plain water and extra moisture was taken out by squeezing the ear buds then lipstick enough for upper lip was applied on one end. A single uniform motion was used to apply lip stick on the upper lip and then on the lower lip using opposite side of the ear bud. Sticking side of a cellophane tape was used to get the lip prints, applying uniform pressure and it was removed by a single attempt. Many attempts were made by applying the shade only once and scotch tape multiple times until a clear pattern showing all details in all quadrants was visible and identification of various areas of the lips were established. It was made sure that uniform pressure was applied to the upper and lower lip and then pasted on an A4 paper which was used as a permanent record. These patterns were then carefully observed by one

observer with the help of a magnifying lens deluxe magnifier (75 mm Diameter) to study them in detail in each topographic area Figure 1, classifying them according to Suzuki classification.[9] All varieties of lip prints can be present on one lip the quantification of dominant pattern was calculated on numerical superiority of properties of prints in the study. Each lip print was divided into six topographic areas like upper right, upper middle, upper left, lower right, lower middle and lower left as shown in figure 1 and then they were examined by magnifying hand lenses, photographed and then they were documented by the Microsoft Office Picture Manager.

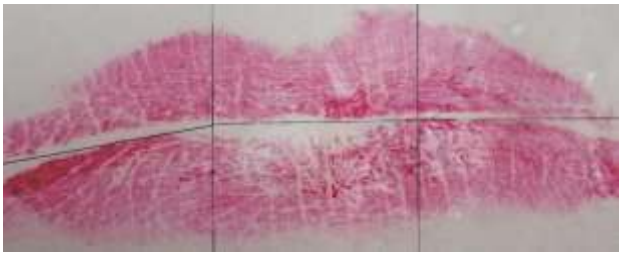

Fig 1: Image Showing Six Topographic Areas from A Female Subject

The data was analysed by using Statistical Package for Social Sciences (SPSS) version 27.0. Numeric data like age was presented in form of mean ± S.D. Categorical data like type of lip prints and was presented in form of frequency. The Chi square test and Fischer's exact were used to compare the type of lip prints between males and females. Mann-Whitney U test was used to compare the number of different types of lip prints between males and females. The *p* value of ≤ 0.05 was considered statistically significant.

Results

Our results showed that the predominant lip pattern was type III, and the least common variety was type V as shown in Table I in terms of frequency and percentages. Type I' II, IV showed statistically significant results whereas type I, III and type V pattern of lip prints were not statistically significant as shown in table I. All participants showed that no two lip patterns were same.

Discussion

Lip prints are exclusive patterns and are unique for every human just as fingerprints are particular for everyone. There is need for contributions from oral biologists, anatomists and forensic odontologists to recognize the diverse features, patterns, prints and other landmarks in the maxillofacial domain. This study showed that patterns of the lip prints were extremely diverse in shapes and sizes yet very unique to every individual. The most common lip print found was type III in both genders. In our study only one male did not show type III lip pattern all 319 subjects had type III variety. Type IV was found in all females and 138 males.

Table I : Distribution of Lip Prints Between Male and Female Study Participants (n=320)

Pattern of Lip Prints	Males	Females	*p* Value
Type I	140 (87.5%)	136 (85.0%)	0.516
Type I'	22 (13.8%)	37 (23.1%)	0.031*
Type II	152 (95.0%)	77 (48.1%)	< 0.001*
Type III	159 (99.4%)	160 (100.0%)	> 0.999
Type IV	138 (86.3%)	160 (100.0%)	< 0.001*
Type V	18 (11.3%)	14 (8.8%)	0.456

The *p* value of ≤ 0.05 was considered statistically significant

The most frequently occurring pattern of lip prints in males was type III followed by type II, type I, type IV, type I' and type V. The most dominant pattern of lip prints in females was type III followed by type IV, type I, type II, type I' and type V. A study conducted by Alzapur *et al*.,[12] showed that distribution of males to females in type I was seen in 45% and 27%, type 1' in 28% and 14%, and type 2 in 10% and 35%, type 3 in 7% and 5%, type 4 in 2% and 4% and type 5 in 8% and 15% which showed that type I was the common found lip print and type V was the least common. Current study showed that variation exist among different populations in terms of most predominant pattern. In contrast to our study among the Malaysian-Chinese subjects, type V grooves were predominant when both lips were considered together, in all parts of the lower lip. A study conducted by Chadha *et al.,*[13] showed that type III grooves were predominant in the upper lip and all portions of the upper lip evaluated separately in this study. A review of the literature by Maheswari *et al.,*[14] concluded that the most frequent pattern was pattern IV among persons enrolled in it and this also supported our study.

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In current study the upper and lower lip prints showed difference in distribution of the type of lip prints. A study with similar results to our study conducted by Kenneth *et al*., [15] in Nigeria showed different patterns in terms of abundance yet type III was the most abundant.

In a recent study conducted by Tanoli et al., [16] studied the inheritance pattern in 54 families of Pakistani population type I, II, III and IV were found in both males and females. Type II was most common type. Type V was least common in female, whereas type V lip print was not found in males.In our study also, the type V variety of lip prints were the least dominant.

A study conducted by Kaur *et al.,*[17] showed that various basic and combination patterns showed predominance in one of the genders, most of the patterns were not confined to a particular gender. A systematic review by Franco *et al*., [18] revealed weak foundations for the use of lip print analysis for sexual dimorphism in forensic dentistry. Our study also revealed that there was no association of dominant patterns of lip prints with gender (*p* value 0.373) and no significant difference was observed in mean number of lip prints of type I, type IV and type V between the both genders.

Longadon *et al.,* [19] showed that all the quadrants of an individual's lip showed different types of patterns and every quadrant had multiple patterns present similar to our results. It was found that most of the lip print patterns did not comprise of only one pattern but consisted of a mixture of varying types. Hence individuals had similarity in the grooves but the detailed features of lip prints varied. BR *et al.,*[20] found that quality of lip prints depends on the method used and concluded that digital photography can be employed for instant and detailed result.

A study conducted by Samudhrasi *et al*.,[21] suggested the need for studying lip prints in depth and establishing further facts by encouraging research on cheiloscopy. Chaware *et al.,* [22] established that a systematic method should be adopted for the selection, formation, documentation and the final analysis of these patterns. So, it is need of the hour to explore further the applications of cheiloscopy in biometrics and society in general.

Conclusion

Lip prints are useful tools that can be used as biometric markers in dentistry and forensic odontology. Variations exists among prevalence of type of lip prints among genders, but every human has lip prints unique to them.

Limitations

The study is cost effective, yet it requires knowledge and expertise for observation and analysis of individual lip patterns which consumes a lot of time. Recent digital technology can be used for quick and more precise results. Lipstick method provides reliable results but digital photography can provide more accurate results.

Recommendations

This study opens avenues for broader research including various ethnic groups to check the prevalence in our population and maintain a record of lip prints in our community for academic and forensic reasons. The subject specialists must take responsibility for further documentation and research of lip prints in their region and associate it with other biometric markers.

Conflict of Interest

none

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.