

Cheiloscopy in gender determination: A study on 2112 individuals

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ABSTRACT

Background: Lip prints are seen to remain the same for an individual throughout his/her life. Cheiloscopy can be used as an effective tool in the identification of the persons from pieces of evidence that may be left behind from lip prints. **Aim and Objectives:** The aim of the current research was to evaluate the predominant lip groove pattern among Calicut population, Kerala. **Materials and Methods:** The study involved 2112 individuals (1056 males and 1056 females) in the Department of Oral Medicine and Radiology, KMCT Dental College, Calicut, Kerala. Lipstick was used to record the lip groove patterns and the patterns were visualized by magnifying lens after the institutional ethical clearance and informed consent from the individual. Statistical analysis was done using SPSS software 22.0. **Results:** Among the study population, Type 1', Type 1, Type 4, and Type 5 were found to be common lip groove patterns. Males showed predominance on Type 1' and Type 1 lip groove patterns, whereas females showed predominance on Type 4 and Type 5 lip groove patterns. The results were similar when analyzed on upper and lower lips separately on males and females. **Conclusion:** Cheiloscopy is a reliable tool in personal identification and gender determination of an individual. The geographical prevalence of lip groove patterns was reported in the current research and is added to the database of the anthropological data. Studies in different geographical regions will add lip groove patterns on the database in the future and henceforth the potential of cheiloscopy could be further utilized.

Keywords: Cheiloscopy, gender determination, lip print, personal identification

Introduction

The identification of human beings is a process based on certain scientific principles.^[1] There are many methods used in personal identification rather than traditional methods for anthropometry, age estimation, gender determination, differentiation by blood groups, fingerprints, and DNA analysis.^[2] The branch of dentistry that deals with the identification of individuals based on evidence in the court of law is termed forensic dentistry. It includes rugoscopy, cheiloscopy, bite mark analysis, tooth prints, radiographs, photographic study, and molecular methods.^[3]

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Identification in civil and criminal cases requires scientific evidence and support. Cheiloscopy is the technique in which individuals are identified based on the lip groove patterns.^[4] It is possible to identify the lip groove patterns as early as the sixth week of intrauterine life. Lip groove pattern once formed is permanent and does not change permanently following climatic variations, pathology, minor trauma, inflammation, and infections.^[5,6] The salivary and sebaceous secretions from glands located at vermilion border aid in the formation of a latent lip groove pattern.^[7]

Lip groove patterns aiding in criminal investigations have been well documented.^[8] It is an adjunctive mode of identification accepted in the court of law.^[9]

Cheiloscopy is a forensic investigative technique that deals with the identification of individuals based on lip groove patterns.^[10]

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The pattern produced by lip grooves on mechanical surface is termed lip print.^[11] Lip groove patterns are unique and do not change during the entire life of an individual and are invariable and permanent.^[12] In postmortem analysis, lip groove patterns have to be obtained within 24 h of death to prevent any possible postmortem mechanical degradation of lip mucosa.^[1]

Apart from forensic medicine, particular types of lip print patterns have been associated with the occurrence of non-syndromic cleft lip with or without cleft palate and numerous studies are underway to establish facts.^[13] Parents of patients affected with cleft lip and/or palate have been shown to have a particular lip print pattern. The study of lip prints in understanding the inheritance of various congenital anomalies can, therefore, be a useful tool in primary care of diseases. This provides a cost-effective, noninvasive screening method to evaluate the occurrence of clefts in the offspring.

There are reported studies on the gender differences among the lip groove patterns of individuals. Lack of comprehensive database is a major roadblock in the progression and establishment of cheiloscopy as a distinctive supporting branch in forensic dentistry.

The aim of the current research is to determine the common lip groove pattern among Calicut population, evaluate the variation in lip groove patterns and gender-wise comparison of lip groove patterns.

Methodology

The study was carried out from January 2017 to January 2019 on 2112 individuals (1056 males and 1056 females) aged from 15 to 60 years in KMCT Dental College, Calicut. Excluded criteria are 1) persons with lip scar, 2) lip lesions, 3) lip congenital deformities, and 4) persons with hypersensitivity to lipsticks.

The study protocol and objectives were thoroughly explained to the participants and informed consent was taken from them. The Institutional Ethics Committee of KMCT Dental College has approved the research.

Materials used to record the lip groove patterns were: red-colored lipstick, cellophane tape, white paper, and magnifying lens. Costa and Caldas technique^[14] was used to record the lip groove pattern.

The individuals' lips were cleaned with a wet tissue before starting the procedure. The lipstick was gently applied to both lips and the individuals were asked to roll the lips in a uniform manner from center to the corner of lips.^[15] The individual was asked to stop moving the lips during the procedure and to keep the lips in relaxed state. The lip groove patterns were lifted by cellophane scotch tape on upper lip from one side to another; following which the tape was pasted on a white bond paper as a permanent record. The same process was repeated for lower lips. After pasting the lip groove patterns on the bond paper,

the remaining lipstick was cleaned on the lips with a tissue and washed properly.

Lip groove patterns were categorized into four regions predominantly by dropping a perpendicular from the philtrum of lips: upper right (UR) region, upper left (UL) region, lower right (LR) region, and lower left (LL) region. The obtained lip groove patterns were carefully examined under the magnifying lens. The analysis was done as per the Suzuki and Tsuchihashi classification.^[16,17] The classification is as follows: Type I: clear cut grooves running vertically across the lips; Type I': grooves are straight but disappear halfway instead of covering the entire breadth of the lip; Type II: grooves fork in their course; Type III: grooves intersect; Type IV: grooves are reticular; Type V: grooves do not fall into any of the Type I to IV and cannot be differentiated morphologically.

Statistical analysis

The collected data was statistically analyzed using SPSS 22.0 software.

Results

The results noted from the study were the following: Type I (61.5%), Type V (59.5%), Type I' (56.4%), and Type IV (53.1%) form the predominant lip groove patterns in the four regions of lips in the population. Type III (24.7%) and Type II (29.0%) form the least common lip groove patterns in the four regions of lips in the population.

Type I' (92.3%) and Type I (96.8%) lip groove patterns were found to be predominant among all the regions of lips in males. Type IV (93.7%) and Type V (55.6%) lip groove patterns were found to be predominant among all the regions of lips in females.

2112 individuals comprising of 1056 males and 1056 females were assessed for the lip groove patterns. Each individual lips were divided into 4 regions: upper right, upper left, lower right, and lower left. A total of 8448 lip regions ($n = 8448$) were assessed for 6 types of lip groove patterns: Type I, Type I', Type II, Type III, Type IV, and Type V. Mean number of different types of lip groove lines in each region of lips and standard deviation is also assessed [Table 1].

Table 2 shows lip groove patterns among males. 1056 males were assessed for their lip groove patterns. Each individual lips were

Table 1: Lip groove patterns among males and females

Lip Groove Patterns	Number (n) (percentage)	Mean±SD
Type I	5195 (61.5)	3.60±0.33
Type I'	4766 (56.4)	3.25±0.35
Type II	2450 (29.0)	2.58±0.77
Type III	2084 (24.7)	2.57±0.16
Type IV	4483 (53.1)	3.39±0.19
Type V	5033 (59.5)	2.22±0.79

divided into 4 regions: upper right, upper left, lower right, and lower left. A total of 4224 lip regions ($n = 4224$) were assessed for 6 types of lip groove patterns: Type I, Type I', Type II, Type III, Type IV, and Type V. Mean number of different types of lip groove lines in each region of lips and standard deviation is also assessed.

Table 3 shows lip groove patterns among females. 1056 females were assessed for their lip groove patterns. Each individual lips were divided into 4 regions: upper right, upper left, lower right, and lower left. A total of 4224 lip regions ($n = 4224$) were assessed for 6 types of lip groove patterns: Type I, Type I', Type II, Type III, Type IV, and Type V. Mean number of different types of lip groove lines in each region of lips and standard deviation is also assessed.

Lip groove patterns were taken for 2112 males and females and were assessed for the presence of patterns separately in

upper lip and lower lip. Mean and standard deviation is also calculated [Table 4].

Lip groove patterns were taken for 1056 males and were assessed for the presence of patterns separately in upper lip and lower lip. Mean and standard deviation is also calculated [Table 5].

Lip groove patterns were taken for 1056 females and were assessed for the presence of patterns separately in upper lip and lower lip. Mean and standard deviation is also calculated [Table 6].

Discussion

Different prevalence of lip groove patterns has been reported worldwide. Cheiloscopy could be a useful adjunct in crime scenes, mass disasters, and accidents. It is considered the most important and advisable form of transfer of evidence.^[5,18] Lip prints could be retrieved from glass, cigarette butts, clothes, food material, etc., and it could be done by using aluminum powder and magnetic powder.^[19]

The current research revealed a uniqueness of lip groove pattern and predominance of Type IV and Type V patterns among females and Type I' and Type I patterns among males. Costa and Caldas^[14] and Kumar *et al.*^[12] stated that lip groove patterns can be used as a potential aid in gender determination which is in accordance with the results of current research. Lip groove patterns vary in different parts of lips and it reiterates the fact of uniqueness of lip groove patterns.

According to other studies Type IV lip groove pattern was found to be predominant among Kerala population which is in accordance with the predominant pattern among females in the current research.^[8,20] A cheiloscopic study on Rajasthan population revealed a significant difference among gender, which

Table 2: Lip groove patterns among males

Lip Groove Patterns	Number (n) (Percentage)	Mean±SD
Type I	4089 (96.8)	4.36±0.38
Type I'	3898 (92.3)	3.85±0.14
Type II	1242 (29.4)	2.65±0.89
Type III	1086 (25.7)	2.43±0.28
Type IV	527 (12.5)	0.58±0.38
Type V	2685 (63.6)	2.20±0.76

Table 3: Lip groove patterns among females

Lip Groove Patterns	Number (n) (Percentage)	Mean±SD
Type I	1106 (26.2)	2.84±0.24
Type I'	868 (20.6)	2.65±0.22
Type II	1208 (29.0)	2.55±0.62
Type III	998 (23.6)	2.70±0.87
Type IV	3956 (93.7)	6.19±0.22
Type V	2348 (55.6)	2.23±0.46

Table 4: Lip groove patterns among upper and lower lips in males and females

Upper Lip			Lower Lip		
Lip groove patterns	Number (n) (percentage)	Mean±SD	Lip groove patterns	Number (n) (percentage)	Mean±SD
Type I	2560 (60.6)	2.61±0.29	Type I	2476 (58.6)	3.09±0.35
Type I'	2500 (59.2)	2.94±0.35	Type I'	2454 (58.1)	2.93±0.35
Type II	1654 (39.2)	1.61±0.77	Type II	1492 (35.3)	1.57±0.76
Type III	1468 (34.8)	1.57±0.18	Type III	1522 (36.0)	1.55±0.14
Type IV	2354 (51.8)	2.62±0.20	Type IV	2434 (57.6)	2.62±0.18
Type V	2818 (66.7)	2.21±0.78	Type V	3096 (73.3)	2.22±0.80

Table 5: Lip groove patterns among upper and lower lips in males

Upper Lip			Lower Lip		
Lip groove patterns	Number (n) (Percentage)	Mean±SD	Lip groove patterns	Number (n) (Percentage)	Mean±SD
Type I	1984 (93.9)	3.40±1.34	Type I	1972 (93.4)	4.31±1.41
Type I'	2008 (95.1)	4.22±1.18	Type I'	1996 (94.5)	3.21±1.17
Type II	970 (45.9)	1.65±0.90	Type II	936 (44.3)	1.60±0.89
Type III	872 (41.3)	1.43±1.29	Type III	884 (41.8)	1.42±1.28
Type IV	376 (17.8)	1.04±0.33	Type IV	442 (20.9)	1.07±0.42
Type V	796 (37.7)	1.18±0.75	Type V	1112 (52.7)	1.22±0.76

Table 6: Lip groove patterns among upper and lower lips in females

Lip groove patterns	Upper Lip		Lip groove patterns	Lower Lip	
	Number (n) (Percentage)	Mean±SD		Number (n) (Percentage)	Mean±SD
Type I	576 (27.3)	1.82±1.23	Type I	504 (23.9)	1.86±1.24
Type I'	492 (23.3)	1.66±1.01	Type I'	458 (21.7)	2.64±1.02
Type II	684 (32.4)	1.56±0.63	Type II	556 (26.3)	1.54±0.61
Type III	596 (28.2)	1.71±0.92	Type III	638 (30.2)	1.68±0.82
Type IV	1978 (93.7)	4.20±1.23	Type IV	1992 (94.3)	4.17±1.22
Type V	2022 (95.7)	3.23±0.46	Type V	1984 (93.9)	3.22±0.45

is in accordance with the current research results.^[21] Type IV and Type I lip groove patterns were found to be predominant among Karnataka and Punjab population, which is again consistent with the results of current research.^[22,23]

Type V lip groove pattern was found least common among Indian students and Portuguese population when compared to Yemeni population. Maheswari and Gnanasundaram^[24] reported predominant Type II lip groove pattern among Indian population. A study in Egypt which is equally hot like Somalia showed dominance of Type I and IV patterns.^[25] Manikya S reported Type IV lip groove pattern as predominant among their samples.^[26]

Conclusion

Lip groove pattern is unique to an individual and there are predominant patterns based on the gender of an individual. The anthropological database needs to be established on a wider background with further studies in this regard on other geographical areas of the world also. The missing links regarding the establishment of cheiloscopy as a distinctive branch can be completed with more update on the database regarding the lip groove patterns.

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Declaration of patient consent

The authors certify that they have obtained all appropriate participant consent forms. In the form, the participants have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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