

Evaluation for Correlation of Cheiloscopy and Dermatoglyphics in Gender Determination

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Abstract

Background: Identification of the suspect, living or dead with the help of physical characteristics play a vital role in forensic science. Improved methods of gender determination and personal identification are important in solving criminal cases. Cheiloscopy and dactyloscopy have been proved to be of use in personal identification. The present study aims to evaluate correlation of Cheiloscopy and Dermatoglyphics in gender determination

Materials and Method: 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. For lip print analysis Suzuki and Tsuchihashi classification was followed. For finger print analysis impression of all the fingers were taken. For analysis, the images were cropped and Adobe Photoshop software was used.

Results: Type 1 and 1' lip groove patterns were found to be predominant among males. Type 4 and Type 5 lip groove patterns were found to be predominant among females. Loop finger print patterns were found to be predominant among males. Whorl finger print patterns were found to be predominant among females. Positive correlation (+0.80) was found between loop finger print pattern and Type 1' lip print pattern in males which is statistically significant ($p=0.003$). Positive correlation (+0.75) was found between whorl finger print pattern and Type IV lip groove pattern in females which is statistically significant. ($p=0.005$)

Conclusion: There was definite correlation of Cheiloscopy and Dermatoglyphics in gender determination

Keywords: Cheiloscopy, Dermatoglyphics, Gender determination.

Introduction

Forensic science plays a vital role in the identification of the suspected victim or victimizer of a crime, with the help of physical characteristics. Physical evidence is important to solve criminal cases. Improved methods of gender determination and personal identification are gaining importance in recent years.^[1,2]

Lip patterns and finger print patterns remain the same throughout life and are uninfluenced by

environmental changes and diseases. Cheiloscopy is a forensic investigation technique that deals with identification of humans based on lip traces. A lip print at a crime scene would throw light on many areas of the investigation like the number of people involved, the gender and the behavior pattern of the crime. Edmond Locard was the first scientist to recommend the use of lip prints in personal identification.^[1]

Dermatoglyphics is the term specified to the scientific study of fingerprints. The term "fingerprint" predominantly means an impression of the epidermal ridges of the fleshy distal portion of a finger. It was first given by Harold Cummins in the year 1926.^[3]

Cheiloscopy and dactyloscopy are used in personal identification.^[4,5] The present study aims to evaluate

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the uniqueness of lip prints and thumb print patterns and to establish a correlation between them for gender determination.

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. The study protocol and objectives were thoroughly explained to the participants and informed consent was taken from them. The ethical approval was obtained from Institutional Ethical Committee of KMCT Dental College.

Individuals with normal transition zone between the mucosa and skin of both lips and fingers were selected. The Excluded criteria were persons with lip scar, Lip congenital deformities, active lesions on fingers or lips and persons with hypersensitivity to lip sticks.

Materials used to record the lip groove patterns and finger prints were: red coloured lip stick(Lakme ,india), cellophane tape, ink (kores ,extra dark pad), white paper and magnifying lens. Costa and Caldas technique was used to record the lip groove pattern, Kucken technique was used for the finger print pattern.

The individuals' lips were cleaned with wet tissue before starting the procedure. The lip stick was gently applied to the upper and lower lips and the individual was asked to roll the lips in a uniform manner from centre to the corner of lips.

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. The obtained lip groove patterns were carefully examined under the magnifying lens.

Finger print recording was done by asking the subjects to ink all their finger pads, both right and left hands, and the impression was recorded on a white bond paper. Only one impression was made to avoid artifacts. Then the finger print pattern was studied with the help of magnifying lens and the predominant pattern of 10 finger pads (in each subject) was quantified tabulated and analysed statistically.

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 analysis was done as per the Suzuki and Tsuchihashi classification. 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.^{[6, 7](fig.1)}

The finger prints were categorized as follows: Ridge count of thumb, index, middle, ring and little fingers of both hands, Right hand total finger ridge count (TFRC), Left hand total finger ridge count (TFRC), Absolute finger ridge count (AFRC).The finger prints were qualitatively categorized as Arch (simple arch, tented arch), Loop (ulnar loop and radial loop) and whorl (simple, spiral, double pocket, composite) patterns.^{[3](fig 2)}



Fig 1: Armamentarium: Cheiloscopy



Fig 2: Armamentarium: Dermatoglyphics

Statistical analysis

Obtained data was tabulated and statistically evaluated using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. Normality of the data was assessed by Kolmogorov-Smirnov Test. If data follows normal distribution, Independent ‘t’ test was used. If data follows non-normal distribution, Mann-Whitney ‘U’ test was used. Chi square test: for association of qualitative variables. Pearson’s Correlation was used for assessing the correlation between cheiloscopy and dermatoglyphics .

Results

Type 1 and 1’ lip groove patterns were found to be predominant among males. Type 4 and Type 5 lip

groove patterns were found to be predominant among females (Table 1 and 2)

Loop finger print patterns were found to be predominant among males. Whorl finger print patterns were found to be predominant among females (Table 3-6)

Positive correlation (+0.80) was found between loop finger print pattern and Type 1’ lip print pattern in males which is statistically significant (p=0.003). Positive correlation (+0.75) was found between whorl finger print pattern and Type IV lip groove pattern in females which is statistically significant (p=0.005)(table7)

Table 1: Lip Groove patterns among males. A total of 2112 lip regions among 1056 males were assed for the lip groove patterns and the variables of upper lip and lower lip are compared.

Sl No	Upper Lip			Lower Lip		
	Lip groove patterns	Number (n) (Percentage)	Mean ± SD	Lip groove patterns	Number (n) (Percentage)	Mean ± SD
1	Type I	1984(93.9)	3.40 ± 1.34	Type I	1972(93.4)	4.31 ± 1.41
2	Type I’	2008(95.1)	4.22 ± 1.18	Type I’	1996(94.5)	3.21 ± 1.17
3	Type II	970(45.9)	1.65 ± 0.90	Type II	936 (44.3)	1.60 ± 0.89
4	Type III	872(41.3)	1.43 ± 1.29	Type III	884(41.8)	1.42 ± 1.28
5	Type IV	376(17.8)	1.04 ± 0.33	Type IV	442(20.9)	1.07 ± 0.42
6	Type V	796(37.7)	1.18 ± 0.75	Type V	1112(52.7)	1.22 ± 0.76

Table 2: A total of 2112 lip regions among 1056 females were assed for the lip groove patterns and the variables of upper lip and lower lip are compared.

SI No	Upper Lip			Lower Lip		
	Lip groove patterns	Number (n) (Percentage)	Mean \pm SD	Lip groove patterns	Number (n) (Percentage)	Mean \pm SD
1	Type I	576(27.3)	1.82 \pm 1.23	Type I	504 (23.9)	1.86 \pm 1.24
2	Type I'	492(23.3)	1.66 \pm 1.01	Type I'	458(21.7)	2.64 \pm 1.02
3	Type II	684(32.4)	1.56 \pm 0.63	Type II	556(26.3)	1.54 \pm 0.61
4	Type III	596(28.2)	1.71 \pm 0.92	Type III	638(30.2)	1.68 \pm 0.82
5	Type IV	1978(93.7)	4.20 \pm 1.23	Type IV	1992(94.3)	4.17 \pm 1.22
6	Type V	2022(95.7)	3.23 \pm 0.46	Type V	1984(93.9)	3.22 \pm 0.45

Table 3: Finger print patterns of right hands of 1056 males were recorded. L- Loop, RL- Radial Loop, UL- Ulnar Loop, A- Arch, PA- Plain Arch, TA- Tented Arch, SW- Single Whorl, DW- Double Whorl. N- Total number of finger print patterns of right hands of males (1056 males x 5 right hand fingers = 5280).

SI No	Finger Print Patterns	Number (n) (Percentage)
1	Loop (RL +UL)	3874 (73.4)
2	Arch (PA + TA)	348 (6.6)
3	Whorl (SW + DW)	1058 (20.0)
	Total	5280 (100)

Table 4: Finger print patterns of left hands of 1056 males were recorded. L- Loop, RL- Radial Loop, UL- Ulnar Loop, A- Arch, PA- Plain Arch, TA- Tented Arch, SW- Single Whorl, DW- Double Whorl. N- Total number of finger print patterns of left hands of males (1056 males x 5 left hand fingers = 5280).

SI No	Finger Print Patterns	Number(n) (Percentage)
1	Loop (RL +UL)	4764 (95.2)
2	Arch (PA + TA)	385 (3.1)
3	Whorl (SW + DW)	131 (1.7)
	Total	5280 (100)

Table 5: Finger print patterns of right hands of 1056 females were recorded. L- Loop, RL- Radial Loop, UL- Ulnar Loop, A- Arch, PA- Plain Arch, TA- Tented Arch, SW- Single Whorl, DW- Double Whorl. N- Total number of finger print patterns of right hands of females (1056 females x 5 right hand fingers = 5280).

Sl No	Finger Print Patterns	Number(N) (Percentage)
1	Loop (RL +UL)	322 (6.1)
2	Arch (PA + TA)	540 (10.2)
3	Whorl (SW + DW)	4418 (83.7)
	Total	5280 (100)

Table 6: Finger print patterns of left hands of 1056 females were recorded. L- Loop, RL- Radial Loop, UL- Ulnar Loop, A- Arch, PA- Plain Arch, TA- Tented Arch, SW- Single Whorl, DW- Double Whorl. N- Total number of finger print patterns of left hands of females (1056 females x 5 left hand fingers = 5280).

No	Finger Print Patterns	Number (N) (Percentage)
1	Loop (RL +UL)	459 (8.7)
2	Arch (PA + TA)	497 (9.4)
3	Whorl (SW + DW)	4324 (81.9)
	Total	5280 (100)

Table 7: Gender wise comparison of correlation between predominant finger pattern and lip pattern among males and females. Correlation done by Karl Pearson’s correlation coefficient p value <0.010: HS

Gender	Correlation	P value
Male	r = + 0.8	0.003 HS
Female	R = +0.75	0.005 HS

Discussion

Forensic science plays a definite role in criminal investigation. The victimizers of the infamous Nirbhaya gang rape case (2012) were identified by forensic records. The woman who was part of the hit squad during the Paris attack (2017) was identified by finger prints. Many more such cases were proved by forensic records.

The current research revealed the predominance of Type IV ,Type V patterns among females and Type I’, Type I patterns among males. Costa and Caldas and Kumar et al 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.^[5] Lip groove patterns varies in different parts of lips and it reiterates the fact of uniqueness of lip groove patterns. [8, 9,10, 11]

In our study the Loop finger print patterns were found to be predominant among males and Whorl finger print patterns were found to be predominant among females. The study results were in accordance with tendon et al. ^[12]

The predominant pattern of finger print and lip print also show regional variations. In Iranian sample population, (96 individuals) Type V lip groove patterns was found predominant pattern.^[11] In Saudi population (150 individuals), males showed Type III pattern and females showed Type I pattern as the predominant type.^[8] In our study, Loop finger print patterns with type 1 lip print were found to be predominant among males. Whorl finger print patterns with type 4 lip print were found to be predominant among females. Similarly Gaba et al found that lip prints were unique to an individual and the patterns varied among males and females and concluded that lip print analysis can be used for forensic analysis and gender determination.^[15] Our results are in association with Metgud et al results, who found that correlation between lip prints and finger prints for gender identification was statistically significant.^[16] From our study it can be observed that there is variation in lip print and finger print form one person to other and among gender hence it can be used for identification of gender in forensic medicine. Further long term studies are required on larger sample size with other variables for gender determination.

Conclusion

Most studies on lip prints and thumb prints have limited samples.^[13,14] The current study was done on a larger sample of population, however more studies in different geographic areas with larger populations are needed to establish cheiloscopia and dactyloscopia as distinct branches with wider scope in forensic science.

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