UAR Journal of Arts, Humanities & Social Sciences (UARJAHSS)
Vol. 1, Issue. 7, September 2025
ISSN: 3049-4362
DOI: 10.5281/zenodo.17118362

Forensic Evaluation of Dermatoglyphics and Cheiloscopy: Correlation with ABO Blood Types, Gender, and Age

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Article Info

Article historys:

Received: 01/09/2025
Accepted: 10/09/2025
Published: 15/09/2025

Keywords:

Cheiloscopy, Lip Prints, Forensic Identification, Pattern Analysis, Personal Identification.

ABSTRACT

Cheiloscopy, the examination of lip prints and palm prints, has proven to be a useful forensic tool for identifying individuals. This research investigated the forensic reliability of dermatoglyphics and Cheiloscopy through the analysis of the relationship between lip prints, palm prints, thumbprints, gender, age, and ABO blood groups. Conducted as a cross-sectional observational study among 500 individuals aged 18 to 70 at Ranjeet Deshmukh Dental College and Research Centre, Nagpur, the research employed standardized biometric recording techniques. Lip prints were classified using Suzuki and Tsuchihashi's method, while palm and thumbprints were analysed using forensic classification systems. Statistical analysis, including chi-square tests and Pearson's correlation, was conducted using SPSS to determine
associations. Findings showed lip prints with high correlation with gender, palm prints with correlation to age, and thumbprints with blood groups, proving their forensic application. The research also highlights the need for large population studies and AI-based categorization for precision. In future under resource-poor settings, the data could assist forensic experts in profiling populations and detecting crime. More research would need to focus on multi-regional verification and biometric marker genetics to improve forensic use.

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INTRODUCTION

Identification of humans is mandatory for personal social and legal reasons. Forensic odontology has been shown to play a major role in the identification of human remains. Dentistry is pivotal in forensic investigations, aiding in the identification of individuals in scenarios like mass casualties, accidents, and criminal incidents (1). Gender and age identification is an important aspect of personal identification in forensic investigations using various techniques such as skeletal analysis, dental profiling, and serological examinations, with the ABO blood group being one of the crucial biological identifiers that form before birth and remain consistent throughout life (2).

There are many methods that have been used previously for age and gender determination. Among those methods, identifying individuals through DNA analysis is intricate, time-consuming, and costly. Hence, readily accessible alternatives like lip, thumbprint, and palm print impressions have gained popularity. Their correlation with blood groups has proven particularly useful in developing and remote regions where forensic resources are limited (3).

Lip print analysis, or Cheiloscopy, is a forensic technique that examines the patterns of lines and fissures in the transition zone of the lips(4). Like thumbprint, lip prints are unique to each individual and serve as a reliable method for identification. Although they have a hereditary component, their distinct characteristics ensure individuality, making them a valuable tool in forensic investigations(5). They also hold promise in forensic odontology, aiding in the identification of individuals connected to criminal activities(6). A lip impression typically appears as a multi-layered surface marking with discernible ridges or grooves. Studies suggest that these ridges can regenerate after alterations caused by injury, inflammation, or conditions like herpes, while their overall structure remains unaffected by environmental factors(7).

Similarly, Dermatoglyphics involves the study of fingerprints and palm prints. A palm print refers to the imprints found on the palm, predominantly comprised of the lines and ridges unique to each individual(8). These lines, known as principal lines, are classified based on their location and prominence, including the heart line, the head line, and the life line(9) (10).

Abidullah M. first established a substantial link between lip prints, thumbprint, gender, and ABO blood types in contrast, Gupta et al observed sexual dimorphism in palm prints but found no significance to ABO blood groups. Studies on these biometric markers and their relation with gender, age and ABO blood groups have few limitations that include small sample size, narrow range of age, and non-blinding biases(11).

Therefore, this study was designed to explore the potential correlations between thumbprint patterns, palm prints, lip prints, gender, and blood group types among individuals The research aimed to identify significant associations or trends that could contribute to forensic science and population genetics. The findings from this investigation could contribute to the existing body of knowledge on biometric characteristics and their relationships to other biological factors.

MATERIALS AND METHOD

Study design

This research uses a cross-sectional observational study design to examine the relationship between lip prints, thumbprints, palm prints, gender, age, and ABO blood groups. Performed among 500 volunteers between the ages of 18 and 70 at Ranjeet Deshmukh Dental College and Research Centre, Nagpur, this research seeks to determine meaningful forensic associations between these biometric identifiers. The subjects were chosen on the basis of inclusion and exclusion criteria, without any congenital deformities or print quality-altering conditions. Data collection was done by taking lip impressions with lipstick on unglazed paper, thumbprints with an ink-stained pad, and palm prints with an ink and roller system. The prints were categorized based on the forensic classification systems and statistical analysis was done to identify correlations. Being a cross-sectional study, information was gathered at one point in time to enable the determination of associations and patterns but not causality. The results add to forensic science and population genetics.

To minimize observer bias, blinding was implemented during the classification and analysis of biometric data. The researchers analysing the prints were not provided with participant demographic details such as age, gender, or blood group during the assessment.

Sample size

The sample size for the present study was 500 subjects, both males and females, between the ages of 18 and 70 years. The subjects were patients who visited Ranjeet Deshmukh Dental College and Research Centre (RDDC & RC), Nagpur, Maharashtra. The selection process was based on certain inclusion and exclusion criteria. The sample was selected to offer a varied representation across various age groups and ABO blood groups. The use of such a big sample ensures that the study's reliability is increased, enabling valid statistical correlations in forensic and biometric studies.

Study population

The research sample comprised 500 participants aged 18 to 70, including both men and women, who visited RDDC & RC in Nagpur, Maharashtra. Prior to initiating the study, approval was obtained from the institutional ethics committee.

Inclusion criteria:

1. Provided informed consent to participate in the research.
2. Had no abnormalities affecting their lips, fingers, or palms.

Exclusion criteria:

1. Exhibited congenital deformities such as clefts, or had scars from injuries or diseases that altered the anatomy of their lips, fingers, or palms.
2. Reported history of allergic reactions to materials used in the analysis, including lipstick, ink, or paint.

Statistical Analysis:

All the data gathered were entered into Microsoft excel and analyzed with the statistical package for the social sciences (SPSS) version 26.0. Descriptive statistics, i.e., mean, standard deviation, and frequency distributions, were computed for demographic variables like age and gender. Chi-square tests were used to analyze categorical variables, e.g., the relationship between fingerprint, lip print, and palm print patterns and gender and ABO blood groups. Pearson's correlation coefficient was employed to determine the direction and strength of associations between biometric markers. Bonferroni correction was used where appropriate to account for multiple comparisons and minimize Type I errors. A p-value of <0.05 was used to determine statistical significance. The findings were presented using bar charts, pie charts, and scatter plots where relevant to facilitate the interpretation of trends in biometric distribution.

Methodology

The study included participants who provided informed consent.

1. **Case history** - A brief case history was collected from each subject, including demographic information and blood type. If a subject was unaware of their blood group, they were directed to undergo blood typing.
2. **Acquiring lip impressions** - A brown lipstick was applied to the subject's lips, and they were instructed to distribute it evenly using gentle lip movements. A piece of unglazed white paper was then pressed uniformly against the lips. The resulting lip prints were examined and categorized according to the Suzuki and Tsuchihashi classification.

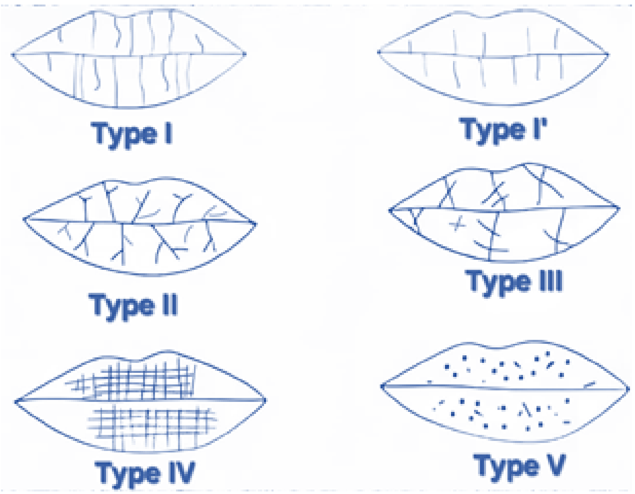

Figure 1 'Suzuki and 'Tsuchihashi classification of lip prints

- 'Type I: Complete vertical- (clear-cut grooves running vertically across the lip)
- ;Type I': ;Incomplete vertical -(the grooves are straight but disappear halfway instead of covering the entire breadth of the lip)
- 'Type II: 'Branched groove- (the grooves fork in their course)
- 'Type III: 'Intersected pattern- (the grooves intersect)
- 'Type IV: 'Reticular pattern- (the grooves are reticular)
- 'Type V: 'Other patterns -(the grooves do not fall into any of the Type I to IV and cannot be differentiated morphologically)

3. **Obtaining thumb prints**: After the thumb was cleaned with water, the individuals were instructed to roll the tip of their fingers across the surface of an already made ink-stained pad, ensuring that the ink covered the entire pattern area. The Inked finger was then enrolled over a white paper to obtain the print and analyzed. The obtained thumb prints was classified and analyzed according to Kucken and Newell classification .

'This classification of thumbprint was performed according to the characteristics of the prints as follows:

- 'Type 1--loop pattern;
- 'Type 2--arch pattern;
- Type 3--whorl pattern.

Figure 2. 'The three primary thumbprint patterns- (From left to right: Arch, Loop and Whorl)

4. **Obtaining palm prints -**

Figure 3. Major principal lines of palm.

The palm prints of both the hands of the individual were recorded by the ink and roller method, as was suggested by Cummins and Midol. The individual was told to wash and dry their hands to get rid of any dirt and grease. Then, with the help of a roller, ink was spread onto each palm one at a time. The entire inked surface of the right hand was gently pressed onto a clean, white paper and quickly taken off. The same process was done for left hand, then the prints were examined using a magnifying glass, and were classified and analysed accordingly; (2).

'Three principal lines on the palm are identified, as follows--

1. **The radial longitudinal crease (Thenar**) - begins from, with, or slightly below the proximal transverse crease at the radial border of the palm over the metacarpophalangeal joint of the index finger and runs proximally toward the wrist curving laterally.
2. **The proximal transverse crease (Hypothenar)** - begins at the radial side of the palm and runs medially slightly curving proximally to terminate at the medial border of the hypothenar eminence. Fingers and runs to the ulnar side of the palm, showing a slight distal ward concavity.
3. **The distal transverse crease (Ulnar / Interdigital)** - It starts from the radial side of the palm, usually below the index finger, and runs transversely toward the ulnar side. It lies above the proximal transverse crease and may appear straight or slightly curved, helping in flexibility of finger movements.

Divided the palm prints into six categories according to the number of their principal lines and the number of intersections."

- Category 1:- 'Palm prints composed of no more than one principal line'
- Category 2: -'Palm prints composed of two principal lines and no intersection'
- Category 3:- 'Palm prints composed of two principal lines and one intersection'
- Category 4:- 'Palm prints composed of three principal lines and no intersection
- Category 5:- ;Palm prints composed of three principal lines and one intersection'
- Category 6: Palm prints composed of three principal line and more than one intersection.'

This classification system provides a useful framework for analyzing lip prints, finger prints & palm print patterns, which can be applied in conjunction with other features to explore potential correlations with various individual characteristics. Although this classifications system offers a standardized approach to analyzing lip prints, finger prints, palm prints, the varying prevalence of different patterns among ethnic groups or geographical region.

RESULT

The study aimed at determining the correlation of lip prints, palmprints and thumbprint with age, gender and ABO blood group. A total of 500 individuals with 183 males and 317 females were part of the study from whom these prints were taken. The collected information was then analyzed and the results obtained are as follows;

'Table 1 Distribution of lip prints among males and females

Correlations with Gender							
	Gender		Total	Chi-square value	degrees freedom	of	P-value
	Female	Male					
Lip prints							
I	97 -19.40%	143(28.60 %)	240 (48.00%)	105.789	4		<0.001 **
II	215(43.00 %)	39 (7.80%)	254 (50.80%)				
III	2 (0.40%)	0 (0.00%)	2 (0.40%)				
IV	2 (0.40%)	1 (0.20%)	3 (0.60%)				
V	1 (0.20%)	0 (0.00%)	1 (0.20%)				
Tota l	317(63.40 %)	183(36.60 %)	500 (100.00 %)				

'Among 183 male individuals, Type I lip print was observed in 143 individuals, Type II in 39, 'Type IV in 1 and Type V in 0 individual. Among 317 female individuals, Type I lip print was 'observed in 97 individuals, Type II in 215, Type III in 2, Type IV in 2, Type V in 1 individual. 'Table 1 shows cross tabulation of chi square test between lip prints and gender. Type II lip 'print 'pattern was found. to be the most pre-dominant whereas Type I was most commonly 'found in males (143) and Type II was most commonly found in females (215). There was a 'significant correlation between lip print pattern and gender. (P < 0.05).

There was no significant correlation of lip prints with age group & ABO blood group (P>0.05)

Table 2 correlation of palmprints with age groups

Correlations with Age Groups									
Age Group						Total	Chisquare value	degrees of freedom	Pvalue
	20-30	30-40	40-50	Above 50	Below 20				
Palmprints									
2	2 (0.40%)	9 (1.80%)	8 (1.60%)	1 (0.20%)	1 (0.20%)	20 (4.00%)	79.575	12	<0.001 **
3	3 (0.60%)	0 (0.00%)	0 (0.00%)	1 (0.20%)	0 (0.00%)	1 (0.20%)			
4	64 (12.80%)	57 (11.40%)	14 (2.80%)	12 (2.40%)	13 (2.60%)	160(32.00%)			
5	149(29.80%)	93 (18.60%)	45 (9.00%)	21 (4.20%)	11 (2.20%)	319(63.80%)			
Total	222(44.40%)	158(31.60%)	60(12.00%)	35 (7.00%)	25 (5.00%)	500(100.0%)			

Table 3 correlation of thumbprints with ABO blood groups

Correlations with Blood Groups										
Blood Group							Total	Chi-square value	degrees of freedom	Pvalue
	A+VE	AB+VE	A-VE	B+VE	B-VE	O+VE	O-VE			
Thumbprints										
A	0 (0.00%)	2 (4.00%)	1 (2.00%)	7 (14.0%)	3(6.00%)	3(6.005)	0 (0.00%)	16 (3.20%)	76.691	12	<0.01 **
B	57 (11.40%)	17 (3.40%)	2 (0.40%)	92 (18.40%)	12(2.40%)	116 (23.205)	3 (0.60%)	299(59.80%)			
C	38(7.60%)	50(100.00%)	0 (0.00%)	54 (10.80%)	3(0.60%)	39 (7.80%)	1 (0.20%)	185(37.00%)			
Total	95(190.00%)	69(130.80%)	3 (0.60%)	153 (30.60%)	18(3.60%)	158 (31.60%)	4 (0.80%)	500(100.0%)			

500 individuals were divided in 5 age groups i.e. below 20 years (25) ,20-30 (222), 30-40 (158),40-50 (60), above 50 (35) years.

Table 2. shows cross tabulation of chi square test between age group and palm prints. Category 5 was found to be ‘the most predominant pattern’ (63.80%) ‘followed by Category 4’(32%), followed ‘by Category 2;(4%) .and ‘Category 3(0.20%). A P – value <0.05 indicates that there was a significant correlation. This means that certain types of palm prints may be more or less common in specific age groups.

There was no significant correlation of lip prints and thumbprints with age group as P-value was greater than 0.05.

When thumbprints of 500 individuals ‘were correlated with blood group, Type B was ‘found to be maximum among O ‘positive blood group (116), ‘Type C was found maximum in B positive individuals (54) and Type A was found maximum in B positive individuals.

Table 3 shows cross tabulation of chi square test between thumbprint and ABO blood group. Type B (Loop pattern) was most predominant (59.80%) followed by Type C (Whorl pattern) of thumbprint (37%) and Type A (Arch pattern) of thumbprint (3.20%). There was a significant correlation between thumbprint pattern and ABO blood group as P- value is less than 0.05.

A P-value > 0.05 was found when correlation of lip prints and palmprints was studied with blood group, this suggest that there was no significant correlation.

DISCUSSION

An individual's identity stems from the juxtaposition of peculiar features that single them out as unique. From the subtle finger and lip prints identification techniques through to the blueprinting of one's DNA in molecular examination, distinguishing features make up the process of establishing who one is. Being able to define oneself as a permanent document and singularity is an ideal requirement for any physical feature to be used as a mode of identification(12).

The prevalence of ;blood groups in the present study conformed to the general trend in the Indian population with the highest frequency of Rh positive and lowest frequency of Rh negative individuals. Between the ABO blood groups, O was the most predominant and AB the least frequent, as in earlier demographic studies(13).

Finger and lip prints, and an individual's blood group, are some of the features that do not change during an individual's lifetime and are therefore useful in forensic identification. Our study was therefore looking to establish:

- The ‘relationship between- lip prints and gender, age, and ABO blood groups.
- The relationship between patterns of thumbprint and gender, age, and ABO blood groups.
- The relationship between palm prints and gender, age, and ABO blood groups.

These results can be used as a starting point for further research into the topic, as few studies exist investigating these parameters.

In the present study, the results revealed that Type I lip print pattern was predominant in males and Type II in females which are in accordance with the study of Mohammed Abidullah (14) and S Patel et al (15). ‘In contrast to the present study,- other studies done by R .P Krishnan et al(16), where Types I and I’ are the predominant types of lip patterns in females, and Type IV is the predominant pattern in males, similarly Bushra Karim et al(17) studied lip print patterns and determined that type III lip prints was most predominant in females and Type II to be in males which is not in correspondence to the present study.

The present study revealed loop pattern of thumbprint ;to be most common in O+ve blood group and whorl pattern of thumbprint in B +ve. Conversely, a study conducted by S.Manikandan et al(9) revealed that Loop pattern of fingers was most common in AB+ve blood group while Arch & Whorl pattern was most common in A+ve blood group.

Similar results to that of study conducted by VR Rekha et al (18) were seen in the present study which showed Type II lip print pattern and category 5 palm print pattern to be the most predominant among the study population. And Category 5 of palm prints was more common in males (76.3%), while Category 4 was more common in females (66.2%) in the study conducted by Anupma Gupta et al(19). Conversely, the present study revealed no significant correlation between palm print and gender.

Frequency of loops was highest in both the Rh-positive and Rh-negative subjects of ABO blood groups; followed by whorls and arches except, blood group AB where the incidences of whorls (43.34% in Rh +ve and 60% in Rh-ve) were more. Incidence of loops varied between 30% (in ‘AB’ negatives) to 60% (in ‘A’ negatives) among the subject of different blood group of whom, blood group A showed highest loops (Rh +ve 54.26%, and Rh -ve 60%)

As the present study aimed to overcome some of the limitations of the studies conducted so far such as narrow range of age and less sample size. This study is conducted in large sample size and a wide range of age.

Although it has certain limitations, such as a smaller number of male individuals as compared to that of female individuals, few number of individuals in higher age group i.e. individual above 50.

This study concludes that there is a significant correlation of lip prints with gender, palm print with age group, thumbprint with ABO blood group. And thus, further studies are needed to eliminate the limitations of our studies thereby making it possible to use these parameters as diagnostic tools in various areas of forensic science in the future.

The present study’s results clear the way for a new area in which these criteria may be used as diagnostic tools in the near future to aid forensic investigations where DNA analysis is unavailable.

CONCLUSION

This research verifies that lip prints are associated with gender, palm prints with age, and thumbprints with blood group, supporting their forensic utility. There was no association, however, between lip prints and age or blood group, palm prints and gender or blood group, and thumbprints and gender or age. These results indicate that lip, palm, and thumbprint prints can be used as additional forensic instruments, especially when DNA is not available. They cannot substitute for main identification procedures but provide extra biometric characteristics that could assist in forensic analysis.

FUTURE OUTLOOK

Subsequent studies should aim at multi-region validation, genetics of biometric variables, and AI-driven classification approaches to enhance accuracy and usability in forensic analysis.

REFERENCES

1. Bai JKS, Prakash AR, Reddy AVS, Rajinikanth M, Sreenath S, Kumar Reddy KVK. Correlative study on lip prints, fingerprints, and mandibular intercanine distance for gender determination. J Forensic Dent Sci. 2018;10(3).
2. Biswas A, Babu GS, Shetty M, Rao K, Narayan B, Sakthivel S. Correlation of lip prints, palm prints and abo blood group among student based population in Mangalore. Int J Appl Dent Sci. 2020;6(4):452–8.
3. Devaki T. Triad of cheiloscopy, Dactyloscopy and blood grouping-A Correlation study. Int Dent J. 2024;74:S34–5.
4. Debta FM, Debta P, Bhuyan R, Swain SK, Sahu MC. Heritability and correlation of lip print , palm print , fingerprint pattern and blood group in twin population. 2018;
5. Yamunadevi A, Maheswaran T. Cheiloscopy: An Evolving Tool in Forensic Identification. 2018;(December).
6. Patel S, AS M, Ramesh G, GV S. A study of lip prints in relation to gender, family and blood group. Int J Oral Maxillofac Pathol. 2010;1(1):4–8.
7. Verma P, Sachdeva SK, Verma KG, Saharan S. Correlation of Lip Prints with Gender , ABO Blood Groups and Intercommissural Distance. 2013;5(7):427–31.
8. Potdar S, Sudeep CB, Khanapure S, Suhas HG, Arjun MR. Association between cheiloscopic patterns and ABO blood groups among South Indian population. J Contemp Dent Pract. 2017;18(7):596–600.

9. Article O. Dermatoglyphics and Their Relationship With Blood Group: An Exploration. 2019;285–8.
10. Sandhu H, Verma P, Padda S, Raj SS. Frequency and correlation of lip prints, fingerprints and ABO blood groups in population of Sriganganagar District, Rajasthan. Acta Med Acad. 2017;46(2):105–15.
11. Eboh DEO. Fingerprint patterns in relation to gender and blood group among students of Delta State University , Abraka , Nigeria. 2013;12(2).
12. Maled V, Khode V, Maled D, Jain A, Male S, Ruikar K. Original Research Paper Pattern of Fingerprints in Different ABO and Rh Blood Groups Introduction : Corresponding Author : Discussion : 2015;37(2):2014–6.
13. Maiduguri R, Ekanem AU, Abubakar H, Dibal NI. A Study of Fingerprints in Relation to Gender and Blood Group among A Study of Fingerprints in Relation to Gender and Blood Group among Residents of Maiduguri , Nigeria . 2014;(December 2017).
14. Abidullah M. Triad of Cheiloscopy, Dactyloscopy, and Blood Groups: Does it Signify Anything? 2023;27–30.
15. Murugan M, Karikalan T. A study of relative correlation between the pattern of finger prints and lip prints. J Evol Med Dent Sci. 2014;3(56):12768–73.
16. Krishnan RP, Thangavelu R. Gender determination : Role of lip prints , finger prints and mandibular canine index. 2016;(1):2329–32.
17. Karim B, Gupta D. Cheiloscopy and blood groups : Aid in forensic identification q. Saudi Dent J 2014;26(4):176–80.http://dx.doi.org/10.1016/j.sdentj.2014.05.005
18. Sunil S, Rathy R. Heritability and Correlation of Lip Prints and Palmprints in South Kerala Population. :544–9.
19. Article O. Prevalence of Palm-Print Patterns and their Association with ABO Blood Group and Gender, among Medical Students of North India. 2022;203–8.