

Patterns of Lip Print and Fingerprint in Gender Identification: A Cross-sectional Study

Radha Baral¹ • Ganesh Silwal² • Dinesh Kumar Yadav¹ • Sushmit Koju¹ • Nisha Maharjan¹ • Dipshikha Bajracharya¹

Abstract

Background: Personal identification is one of the key areas in the forensic sciences. A combination of different simple and easily available methods such as lip prints and fingerprints can be used for human identification. Our objective was to analyze the types of lip print and fingerprint patterns in dental students and to identify if they were associated with gender.

Methods: This was a cross-sectional comparative study conducted in 150 students (male: female 1:1), aged between 17 to 34 years, from Kantipur Dental College. The lip print and fingerprint patterns were recorded and interpreted based on the Tsuchihashi and Michael Kucken classification respectively.

Results: The most common lip print pattern was intersected type (44, 29.3%), while the least common was undetermined type (7, 4.7%). The intersected lip pattern (23, 30.7%) was most prevalent in males and the vertical pattern (28, 37.3%) was most prevalent in females ($p < 0.05$). The loop-type (82, 54.7%) fingerprint pattern was the most common while the arch-type (19, 12.7%) was the least common. The most common fingerprint pattern in both sexes was loop pattern (38, 50.7%).

Conclusion: The type of lip print pattern holds potential promise as a supplementary tool for gender identification. However, fingerprint pattern was not associated with gender.

Keywords: fingerprints, forensic sciences, gender, lip prints, personal identification

Personal identification is one of the key areas in the forensic sciences.¹ Deoxyribonucleic acid (DNA) comparisons and fingerprint analyses are techniques employed to ensure reliable identifications in terms of unique identity. There are certain crime scenarios where other supplemental aids like lip prints, palatal rugae patterns and bite marks become necessary since human identification involves a combination of different procedures for individualizing a person.^{2,3}

Lip prints are the normal lines and furrows in the form of wrinkles and grooves present in the human lip having certain individual characteristics like fingerprints. These grooves occur as distinct patterns or types and are unique to each individual and thus can be used to identify a person.^{4,5} Study of lip prints is known as Cheiloscopy.⁵ Although many classifications have been proposed for lip prints, the classification proposed by Suzuki and Tsuchihashi is the most widely used.^{6,7}

Dermatoglyphics is the scientific study of epidermal ridges and their configuration on the volar aspect of the palmar and plantar regions.⁸ The palmar surfaces of hands have friction ridges known as papillary or epidermal ridges. The establishment of these epidermal ridges takes place from the 10th to 16th weeks of development. These remain unchanged from birth till death.^{3,9}

The use of lip print and fingerprint evidence is crucial in many scenarios because DNA analysis, a more specific technique is costly and not easily available for resource limited developing countries.^{9,10} Although, many studies^{4,5} have been conducted on lip print pattern for gender identification, only few studies are done combining both lip print and fingerprint in the Nepalese population. This study aimed to analyze the patterns of lip print and fingerprint and to assess if they were associated with gender.

METHODS

This was a cross-sectional study conducted in Kantipur Dental College, Basundhara, Kathmandu from July to December, 2019 among undergraduate and post-graduate dental students of first, second and third year. Ethical clearance was obtained from the Institutional

 **Radha Baral**
radhabarall22@gmail.com

¹ Department of Oral Pathology, Kantipur Dental College, Basundhara, Kathmandu, Nepal

² Medical Officer, Nuwakot Sanjivani Hospital, Nuwakot

Review Committee of Kantipur Dental College. A total of 150 students (male: female 1:1) were selected based on the non-probability (purposive) sampling method. Students willing for the study with no history of allergy to any material used for taking lip print and fingerprint were selected. Those with congenital lip abnormalities, inflammation, trauma or scar of lips, and permanent scars on their thumbs were excluded.

After taking a written informed consent, each participant was asked to gently clean and dry his/her lips with tissue paper. A dark red colored lipstick was applied evenly in one stroke with the help of earbud. Then the participant was asked to spread it uniformly by gentle movements of the lips. The sticky side of the cellophane tape was placed over the lips in a resting position and then pressed uniformly for about 10 seconds. The tape was gently removed from the lips without distorting the lip print. Cellophane tape was then stuck to a white blank sheet of paper. The middle third portion of the lower lip was considered for the analysis as this area is always present in a lip print. For recording fingerprints, the imprint of the left thumb was recorded using an ink pad on white blank sheets of paper after cleaning and drying the hand.

The lip and fingerprint patterns were examined with a magnifying lens and classified based on the Tsuchihashi and Michael Kucken classification respectively.⁶ The Tsuchihashi system^{6,7} classifies the lip prints as: type I (Clear cut vertical grooves that run across the entire lips), type I' (Similar to type I, but the grooves do not cover the entire lip), type II (Branched grooves), type III (Intersected grooves), type IV (Reticular grooves), and type V (Grooves do not fall into any of the types I–IV and cannot be differentiated morphologically (undetermined)). For convenience, both type I and type I' patterns of Tsuchihashi classification were considered as vertical pattern or type I pattern.

The Michael Kucken system^{6,9} classifies fingerprint ridges into the three basic patterns: arch (plain and tented), loop (radial and ulnar, double or pocket), and whorl (plain). An arch is a pattern where the ridges enter from one side of the finger, rise in the center forming an arc, then exit from the other side of the finger; a loop is a pattern where the ridge enters from one side of a finger, forms a curve and tends to exit from the same side they entered; and a whorl pattern ridge forms circularly around a central point on the finger.

Data analysis was done with the help of the Statistical Package for the social sciences (SPSS) Version 21. The data was presented in frequency distribution and percentage. The association between lip print, fingerprint, and

gender were tested using the Chi-square test.

RESULTS

Among a total of 150 students, 75 each were males and females. The participants were between 17 to 34 years (mean 22.5 ± 3.73 years). There was no missing data. The most common lip print pattern among all participants was intersected ($n = 44, 29.3\%$) followed by vertical ($n = 38, 25.3\%$), reticular ($n = 35, 23.3\%$) and branched ($26, 17.3\%$). The undetermined pattern ($n = 7, 4.7\%$) was found to be the least prevalent (Fig. 1) (Table 1).

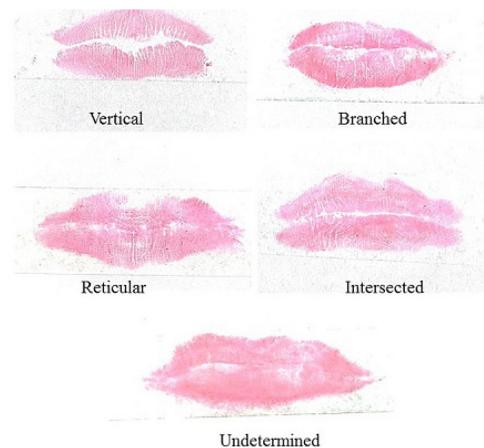


Figure 1. Lip prints of the participants recorded and classified according to Tsuchihashi

Table 1. Distribution of Lip print patterns among the participants

Lip print patterns	Frequency (n)	Percentage (%)
Vertical	38	25.3
Branched	26	17.3
Intersected	44	29.3
Reticular	35	23.3
Undetermined	7	4.7
Total	150	100.0

The distribution of different lip print patterns in males and females is given in figure 2. The most common lip print pattern in males was intersected (30.7%), while the most common pattern in females was vertical (37.3%). The distribution of lip print pattern among sexes was significantly different ($p < 0.05$).

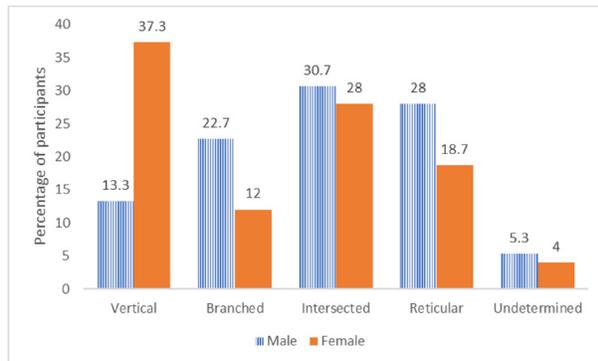


Figure 2. Gender wise distribution of lip print patterns

The most common fingerprint pattern was a loop type ($n = 82$, 54.7%), followed by whorled ($n = 49$, 32.7%) and arch type ($n = 19$, 12.7%) (Fig. 3) (Table 2). The least common type of fingerprint pattern was an arch type ($n = 19$, 12.7%).

Table 2. Distribution of fingerprint patterns

Patterns of fingerprint	Frequency (n)	Percentage
Arch	19	12.7
Loop	82	54.7
Whorl	49	32.7
Total	150	100.0



Figure 3. Fingerprints of participants recorded and classified according to Michael Kucken System

The most common fingerprint pattern in both male ($n = 38$; 50.7%) and female ($n = 44$; 58.7%) was the loop pattern (Fig. 4). There was no statistically significant association between fingerprint type and gender ($p = 0.277$). There was no association between the types of lip print patterns and fingerprint patterns.

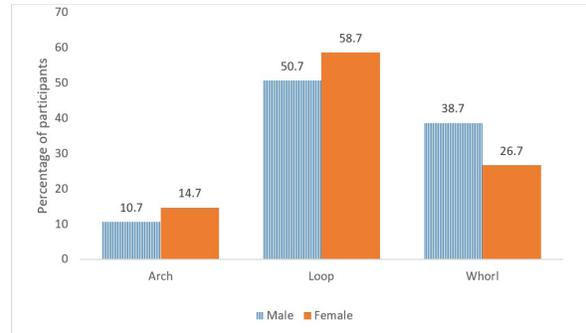


Figure 4. Gender wise distribution of fingerprint patterns

DISCUSSION

In the present study, the intersected lip print pattern was the most common lip print pattern ($n = 44$, 29.3%) and the undetermined pattern was the least common pattern ($n = 7$, 4.7%). Selvamani M et al. also observed the similar pattern in students from South India.¹¹ These findings are also in accordance with the study done by Devi A et al. which found intersected lip print patterns as the most common lip print pattern.¹² Intersected lip print pattern was predominant in both male and female in almost all compartments of the lip in another study.¹³

These findings are in contrast with the study done by Sandhu H et al. which shows branched type lip print pattern as the most common lip print pattern in the Rajasthan population.⁹ Bajracharya D et al. found vertical lip pattern as the most common and the undetermined pattern the least common in dental students.¹⁴ However, another study in Nepal found branched lip pattern as the most common and reticular pattern as the least common lip patterns in students of Kathmandu University.⁵ These contrasting findings might be due to the variations in the lip print pattern which may be characteristic of a population.¹⁵

In the present study, the most common lip print pattern in male was the intersected (23, 30.7%) and the most common lip print pattern in females was the vertical pattern (27, 37.3%) and there was a statistically significant difference in lip print patterns of male and female ($p < 0.05$). Similar to the present study, Multani M et al. and Kumaran S et al. reported intersected and vertical lip print patterns to be the most common in males and females respectively. They found a highly significant difference in the distribution of lip print patterns in males and females.^{16, 17} Srilekha N et al. also found the vertical pattern to be the most common lip print pattern in females.² Similarly, Selvamani M et al. found intersected pattern as the

most common pattern in males.^{11,14} In a study conducted by Sivapathasundharam B et al., intersected lip print pattern in the center of the lower lip was the most common in both males and females.¹⁸

However, another study revealed the branched pattern as the most common pattern in most of the quadrants in both males and females.¹⁹ Ghimire N et al. analyzed quadrant wise and gender-wise predilection of lip print pattern in which vertical lip print pattern was more common in most of the quadrants in males and females.⁴ Another study has shown a vertical pattern as the most common pattern in males and branched pattern as the most common pattern in the females.⁵

In our study, the most predominant type of fingerprint pattern was the loop type (n = 82, 54.7%) followed by the whorled (49, 32.7%) and arch type (19, 12.7%). Similar to this study, Kumaran S et al. also found loop pattern as the most common type (65%), followed by the whorled (26%) and arch type (8%) of fingerprint.¹⁷ There was no significant difference in fingerprint patterns of males and females in the present study. These findings are in accordance to the studies done by Nagasupriya A et al. and Kumaran S et al.^{17, 19} Another study also revealed the loop fingerprint pattern as the most common pattern followed by whorl and arch type in both sexes suggesting an insignificant role of fingerprint in gender identification.²⁰

In the present study, there was no statistically significant association between lip print pattern and fingerprint pattern which is in accordance with the study by Nandan SRK et al and Negi A et al.^{1, 6} In contrast, other studies reported a significant correlation between lip print pattern and fingerprint pattern.^{14, 17}

The use of the fingerprint pattern has been established in personal identification in forensic science, unlike lip print. The present study suggests lip print patterns can also be a useful supplement for personal identification in criminal scenes like sexual assaults when trace evidence is present. The lip prints on a drinking glass, clothing, or cigarette butt found at crime scenes may be a link to a suspect and can be obtained for up to one month after being produced.⁹ However, studies consisting of larger sample sizes and from diverse geographic regions are necessary for further exploration of the association of lip print with fingerprint.

CONCLUSION

Fingerprints have been popularly used as a tool for personal identification in the forensic study for years. The present study advocates lip prints also hold potential

promise as a supplementary tool for identification. The association of lip print pattern with gender in this study suggests that it can also provide a link for the identification of the gender of an individual. However, fingerprint pattern was not associated with gender.

DECLARATIONS

Ethics approval and consent to participate: Ethical approval obtained from the Institutional Review Committee of Kantipur Dental College. Written informed consent taken from each participant.

Consent for publication: Obtained

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. All relevant data are within the manuscript and its supporting information files.

Competing interest: None

Funding: None

Author's contributions: RB: concept, design, clinical studies, manuscript preparation, and manuscript editing/review. GS: concept, design, clinical studies, data acquisition, statistical analysis, manuscript preparation, and manuscript editing/review. DKY: data acquisition, statistical analysis, manuscript preparation, and manuscript editing/review. SK: literature search, clinical studies, data analysis, and manuscript editing/review. NM: literature search, clinical studies, data analysis, and manuscript review. DB: literature search, data analysis, and manuscript editing/review.

Acknowledgement: The authors would like to acknowledge all the students who participated in the study and Dr. Bidhata Ojha for their assistance and support.

REFERENCES

1. Nandan SRK, Bandaru BK, Santosh ABR, Thankappan P, Chundru NSV, Amudala R. A study on association and correlation of lip and finger print pattern analysis for gender identification. *J NTR Univ Heal Sci.* 2015;4(3):176–81.
2. Srilekha N, Anuradha A, Srinivas GV, Devi RS. Correlation among lip print pattern, finger print pattern and ABO blood group. *J Clin Diagnostic Res.* 2014;8(3):49–51.
3. Harsha L, Jayaraj G. Correlation of lip print, finger print and blood groups in a Tamil Nadu based population. *J Pharm Sci Res.* 2015;7(9):795–9.
4. Ghimire N, Ghimire N, Upadhyay S, Budhathoki SS, Subba A, Kharel B et al. Lip print pattern: an identification tool. *Health Renaissance.* 2013;11(3):229–33.
5. Karki RK. Lip prints: an identification aid. *Kathmandu Univ Med J (KUMJ).* 2012;10(38):55-7.

6. Negi A, Negi A. The connecting link! Lip prints and fingerprints. *J Forensic Dent Sci.* 2016;8(3):177–8.
7. Karn A, Karna R, Bajgain P, Mandal BK. Morphological patterns of lip prints in relation to gender in a defined cohort. *Eur J Forensic Sci.* 2015;2(1):14–7.
8. 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. *J Oral Maxillofac Pathol.* 2018;22(3):451.
9. 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.
10. 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):12768–72.
11. Selvamani M, Meghala P, Nandini DB. Study of lip print pattern in Kerala sample population. *Int J Curr Res.* 2016;8(11):41279–82.
12. Devi A, Kumar V, Singh N. The study of inheritance analysis and evaluation of lip prints in individuals. *J Forensic Dent Sci.* 2015;7(1):49–53.
13. Saraswathi T, Mishra G, Ranganathan K. Study of lip prints. *J Forensic Dent Sci.* 2009;1(1):28–31.
14. Bajracharya D, Mainali A, Vaidya A, Thapa S, Pandey S. Cheiloscopy: an aid in gender identification. *J Nepal Dent Assoc.* 2013;13(2):80–3.
15. Vats Y, Dhali JK, Kapoor AK. Gender variation in morphological patterns of lip prints among some north Indian populations. *J Forensic Dent Sci.* 2012;4(1):19–23.
16. Multani S, Thombre V, Thombre A, Pratik S. Assessment of lip print patterns and its use for personal identification among the populations of. *J Int Soc Prev community Dent.* 2014;4(3):170–4.
17. Kumaran S, Kumar L, Patel S. Correlation between fingerprint and lip print pattern in Gujarati population. *Medico-Legal Update.* 2017;17(1):217–21.
18. Sivapathasundharam B, Prakash PA, Sivakumar G. Lip prints (cheiloscopy). *Indian J Dent Res.* 2001;12(4):234–7.
19. Nagasupria A, Dhanapal R, Reena K, Saraswathi T, Ramachandran C. Patterns - "A crime solver." *J Forensic Dent Sci.* 2011;3(1):3–7.
20. Naik R, Ahmed Mujib BR, Telagi N, Hallur J. Comparative analysis of lip with thumbprint: An identification tool in personal authentication. *J Oral Maxillofac Pathol.* 2017;21(1):171–5

How to Cite

Baral R, Silwal G, Yadav D, Koju S, Maharjan N, Bajracharya D. Patterns of lip print and fingerprint in gender identification: a cross-sectional study. *JBPKIHS.* 2020;3(2):18–22.