

Study of Lip Print in Sex Identification

Niranjan Shrestha¹, Bhunikala Limbu¹, Barsika Katwal¹

¹ Department of Forensic Medicine, Nepal Medical College, Kathmandu, Nepal

Article Info:

Received Date: June, 2025

Acceptance Date: August, 2025

Corresponding Author:

Niranjan Shrestha
Department of Forensic Medicine,
Nepal Medical College,
Kathmandu, Nepal
Email:
niranjanshrestharu@gmail.com

Funding sources: None

Conflict of interest: None

Access the article online



DOI: 10.70027/jrahs83

Abstract

Introduction: Cheiloscopy is the study of unique furrows on the vermillion border of lips, evolving as a valuable forensic identification method. This study evaluates lip print patterns among Nepalese medical students to establish baseline data for forensic applications in Nepal's disaster-prone context.

Methods: A cross-sectional study was conducted among 100 randomly selected VII semester MBBS students (50 males, 50 females) aged 18-35 years at Nepal Medical College. Lip prints were obtained using dark lipstick and cellophane tape, then classified according to Suzuki and Tsuchihashi's system. Blood group data was collected to explore potential correlations. Data was analyzed using SPSS version 20 with Chi-square test.

Results: Type II lip prints were most common (26%), followed by Types I' and IV (18% each). Females predominantly showed Types I (24%), I' (22%), and II (36%), while males exhibited Types III (20%), IV (28%), and V (18%). Blood group A was most prevalent (33%), followed by O (27%), AB (24%), and B (16%). No significant correlation was found between blood groups and lip print patterns. All lip prints demonstrated individual uniqueness despite categorical classification.

Conclusion: Lip prints show distinct gender-related patterns and individual uniqueness among Nepalese medical students, supporting their potential application in forensic identification within Nepal's medico-legal system. Blood group distribution reflects regional genetic variation but shows no correlation with lip print morphology.

Keywords: blood groups, cheiloscopy, forensic identification, Nepal medical students, lips prints

Introduction

Cheiloscopy is the study of furrows or grooves present on the vermillion border of human lips, also known as sulci laborium rubrorum. The term derives from Greek words "cheilos" (lips) and "scopy" (to see). These groove patterns are unique and individualistic, making them valuable for identity determination based on Locard's Exchange Principle, which states that material transfer occurs when two objects contact each other.¹⁻³

In Nepal's context, cheiloscopy holds particular significance due to the country's vulnerability to natural disasters such as earthquakes, floods, and landslides,

which often result in mass casualties requiring reliable identification methods. Traditional identification methods may be compromised in disaster scenarios, making alternative approaches like cheiloscopy crucial for Nepal's forensic infrastructure. The 2015 earthquake highlighted the urgent need for robust identification systems in Nepal, where conventional methods faced limitations due to body decomposition and infrastructure damage.⁴

The vermillion border contains sebaceous and sweat glands whose secretions create latent lip prints similar to fingerprints. While grooves exist on both upper and lower lips, the central portion is primarily utilized for identification as it remains consistently visible in traces.

Citation:

Shrestha N, Limbu B, Katwal B. Study of Lip Print in Sex Identification. JRAHS Journal of Rapti Academy of Health Sciences. 2025;2(2):29-33.

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This characteristic uniqueness parallels fingerprints, DNA analysis, and other established forensic identification methods.⁵⁻⁶

Human identification through lip prints offers several advantages in forensic investigations.⁷ Lip impressions at crime scenes can establish direct connections to suspects, particularly when found on surfaces like glasses, cigarette butts, or clothing. Recent developments in persistent lipsticks have not diminished the value of lip print analysis, as extraction remains possible using aluminum or magnetic powders.⁸⁻⁹

Despite global recognition of cheiloscopy's forensic potential, limited research exists within Nepal's population. Within South Asia, partial cheiloscopic research exists, primarily from Indian populations. Studies by Sharma et al¹⁰ and Kumar et al²¹ demonstrate similar gender-related patterns, with females predominantly exhibiting linear patterns (Types I, I', II) and males showing complex patterns (Types III, IV, V).

Our study supports this regional trend while establishing Nepal-specific baseline data, contributing to broader South Asian forensic understanding lip print patterns among Nepalese individuals is essential for establishing baseline data, developing standardized protocols, and training forensic personnel. Additionally, exploring potential correlations between lip print patterns and genetic markers like ABO blood groups may enhance forensic identification accuracy. This study aims to analyze lip print patterns among medical students in Nepal, contributing foundational knowledge for future forensic applications in the country.

Methods

This cross-sectional descriptive study was conducted at Nepal Medical College during the winter months of 2014, spanning December through February. Ethical clearance was secured from the Institutional Review Committee under reference number 069/070, with all participants providing written informed consent after comprehensive briefing about study objectives. The research adhered to strict confidentiality protocols, maintaining participant anonymity through coded identifiers throughout the data collection and analysis phases. The study population comprised 100 VII semesters undergraduate MBBS students from Nepal Medical College, Attarkhel, Jorpati, Kathmandu, selected through non-probability purposive sampling to achieve equal gender representation with 50 males and 50 females. Participants were included if they were aged 18-35 years, possessed normal lip anatomy with intact transition zones between mucosa and skin, had pathology-free lips, and consented to provide blood group information, while those with lip deformities,

trauma, lesions, lipstick hypersensitivity, or unwillingness to participate were excluded from the study.

The lip print acquisition protocol involved cleaning participants' lips before applying dark-colored lipstick, followed by careful placement of cellophane tape over the lipstick-covered surface. Participants created impressions in their natural resting position by dabbing centrally and pressing uniformly toward the lip corners, after which the tape was meticulously removed and permanently adhered to white chart paper for detailed examination under magnifying lens. Blood group data was systematically collected from medical records or through participant self-reporting to explore potential correlations with lip print morphology. The resulting lip impressions were classified according to the established Suzuki and Tsuchihashi system, which categorizes patterns into six distinct types ranging from clear-cut vertical grooves covering entire lips (Type I) to undetermined patterns not fitting standard categories (Type V), with intermediate classifications including partial vertical grooves (Type I'), branched configurations (Type II), intersected patterns (Type III), and reticular arrangements (Type IV). Statistical analysis employed SPSS version 20 software, utilizing descriptive statistics for demographic characterization and inferential statistics including Chi-square tests for categorical variable associations, with statistical significance determined at $p < 0.05$.

Results

Among 100 participants, distinct gender-related patterns emerged in lip print distribution. The data from 100 respondents shows that the majority (78%) were aged between 23 and 24 years. The gender distribution was equal with 50% males and 50% females. All participants (100%) identified as Hindu.

Lip Print Pattern Distribution: Type II pattern was most prevalent overall (26%), followed by Types I' and IV (18% each). Female participants (n=50) predominantly exhibited Type II: 18 participants (36%), Type I: 12 participants (24%), and Type I': 11 participants (22%). Male participants (n=50) commonly showed Type IV: 14 participants (28%), Type III: 10 participants (20%), and Type V: 9 participants (18%).

Age and Blood Group Distribution: Age distribution ranged from 21-35 years, with majority participants aged 23 years (43%) and 24 years (35%). Blood group distribution showed A as most common (33%), followed by O (27%), AB (24%), and B (16%). Despite categorical classification, no two lip print sets were identical, confirming individual uniqueness of each pattern.

Table 1: Socio-demographic Characteristics (N=100)

Variable	Frequency	Percentage
Age in years		
21-22	15	15.0
23-24	78	78.0
25+	7	7.0
Gender		
Male	50	50.0
Female	50	50.0
Grade		
VII semester	100	100.0

Table 2: Frequency of Lip Print Patterns (N=100)

Type of Lip Print	Frequency	Percentage
I	14	14.0
I'	18	18.0
II	26	26.0
III	13	13.0
IV	18	18.0
V	11	11.0
Total	100	100.0

Table 3: Type of Lip Print in Relation to Gender (N=100)

Type of Lip Print	Male %	Female %	Total %
I	2 (2.0%)	12 (12.0%)	14 (14.0%)
I'	7 (7.0%)	11 (11.0%)	18 (18.0%)
II	8 (8.0%)	18 (18.0%)	26 (26.0%)
III	10 (10.0%)	3 (3.0%)	13 (13.0%)
IV	14 (14.0%)	4 (4.0%)	18 (18.0%)
V	9 (9.0%)	2 (2.0%)	11 (11.0%)
Total	50 (50.0%)	50 (50.0%)	100 (100.0%)

Table 4: Age-wise Distribution of Study Subjects (N=100)

Age	Male (%)	Female (%)	Total (%)
21	0 (0.0%)	1 (1.0%)	1 (1.0%)
22	7 (7.0%)	7 (7.0%)	14 (14.0%)
23	24 (24.0%)	19 (19.0%)	43 (43.0%)
24	19 (19.0%)	16 (16.0%)	35 (35.0%)
25	0 (0.0%)	2 (2.0%)	2 (2.0%)
27	0 (0.0%)	1 (1.0%)	1 (1.0%)
28	0 (0.0%)	1 (1.0%)	1 (1.0%)
29	0 (0.0%)	1 (1.0%)	1 (1.0%)
32	0 (0.0%)	1 (1.0%)	1 (1.0%)
35	0 (0.0%)	1 (1.0%)	1 (1.0%)
Total	50 (50.0%)	50 (50.0%)	100 (100.0%)

Table 5: Gender-wise Distribution in Relation to Blood Group (N=100)

Blood Group	Male (%)	Female (%)	Total (%)
A	16 (16.0%)	17 (17.0%)	33 (33.0%)
B	8 (8.0%)	8 (8.0%)	16 (16.0%)
AB	11 (11.0%)	13 (13.0%)	24 (24.0%)
O	15 (15.0%)	12 (12.0%)	27 (27.0%)
Total	50 (50.0%)	50 (50.0%)	100 (100.0%)

Table 6: Frequency of Blood Groups (N=100)

Blood Group	Frequency	Percentage
A	33	33.0
B	16	16.0
AB	24	24.0
O	27	27.0
Total	100	100.0

Table 7: Association between Socio-demographic Variables and Lip Print Patterns (N=100)

Variables	Type of Lip Print Patterns	Chi x ²	p value
	Linear Patterns	Complex Patterns	
Gender		12.50	<0.001
Male	17 (34.0%)	33 (66.0%)	
Female	41 (82.0%)	9 (18.0%)	
Blood Group		2.84	0.417
A	17 (51.5%)	16 (48.5%)	
B	9 (56.3%)	7 (43.8%)	
AB	11 (45.8%)	13 (54.2%)	
O	15 (55.6%)	12 (44.4%)	

Linear patterns include Types I, I', and II; Complex patterns include Types III, IV, and V

Discussion

The current study indicates that Type II lip prints were the most common (26%), which aligns with international studies but contrasts with some South Asian populations where Type I or Type III predominate. This finding is similar to studies by Sharma et al.¹⁰ and Kumar et al.²¹, which demonstrate consistent global patterns despite population differences.

Gender-Related Pattern Distribution: Females predominantly exhibit linear patterns (Types I, I', and II), collectively representing 82% of female participants, with Type II being most common in females (36%). In contrast, males show complex patterns (Types III, IV, and V), representing 66% of male participants, with Type IV being most prevalent in males (28%). This clear gender differentiation supports the potential use of cheiloscopy in forensic sex determination. The statistical

significance of these patterns ($p < 0.001$) indicates that lip print morphology can serve as a reliable gender indicator in forensic investigations. These findings align with international studies by Sharma et al.¹⁰, NagaSupriya et al.¹¹, and El Domiaty et al.¹³, suggesting consistent global patterns despite population differences.

The predominance of Type IV patterns in males (28%) contrasts with studies by Gondivkar et al.¹⁷, Kautilya et al.¹⁹, Kumar et al.²¹ and Neo et al.²³, who observed Type III predominance. This variation may reflect population-specific characteristics among Nepalese individuals, highlighting the importance of establishing region-specific baseline data.

Blood Group Distribution and Correlations: Blood group distribution shows A as most prevalent (33%), followed by O (27%), AB (24%), and B (16%). This distribution differs from typical Nepalese population studies that usually show O as most common, which may reflect the specific demographic of medical students or regional differences within Nepal. The relatively high frequency of A and AB blood groups (57% combined) compared to general population data suggests possible selection bias or regional genetic variation.

Importantly, no significant correlation was observed between blood group and lip print patterns ($p = 0.417$), contrasting with some previous studies that suggested possible associations. This finding indicates that lip print morphology is independent of ABO blood group genetics, supporting its value as a standalone identification parameter. The gender distribution within each blood group remains proportional (approximately 50:50 male-female ratio), indicating no gender bias in blood group distribution.

Age Distribution Analysis: The age distribution shows typical medical student demographics, with 78% of participants aged 23-24 years. This narrow age concentration reflects Nepal's MBBS admission patterns where most students enter directly after completing higher secondary education. This age distribution, while limiting generalizability to broader populations, provides valuable baseline data for the predominant young adult demographic in Nepal.

Forensic Implications for Nepal: For Nepal's forensic system, this study provides crucial foundational data given the country's disaster-prone geography where conventional identification methods may fail.²⁴ The 2015 earthquake highlighted the need for alternative identification approaches when traditional methods are compromised. The complete absence of identical lip prints, despite categorical classification, supports cheiloscopy's forensic potential.¹⁷ This individual uniqueness, combined with pattern persistence and crime scene extractability using aluminum or magnetic powders,⁹ positions lip print

analysis as a valuable addition to Nepal's forensic toolkit.

Study Limitations

The study was conducted only among medical students in urban settings, limiting generalizability to broader populations. Nepal requires expanded cheiloscopy research encompassing diverse populations, age groups, and geographical regions. Additional limitations include single institution representation, winter season data collection only, and limited ethnic diversity representation.

Recommendations

Based on the findings, expanded research across diverse populations, regions, and time periods is essential for comprehensive forensic implementation. Lip print analysis offers a promising supplementary identification method for Nepal's medico-legal system, requiring further development of standardized protocols, personnel training, and population-wide baseline studies. Future research should explore lip print persistence over time, seasonal variations, and ethnic group differences within Nepal's diverse population.

Conclusion

This study concludes that distinct gender-related patterns exist in lip print distribution among Nepalese medical students. Type II patterns predominated overall, with females showing linear patterns and males exhibiting complex patterns. Blood group A was most prevalent, but no significant correlation was found between ABO blood groups and lip print patterns, indicating that these characteristics are independent genetic traits.

Despite being categorized into types, all participants showed individual uniqueness in their lip print patterns, supporting the forensic value of cheiloscopy. The findings establish baseline data for Nepal's forensic applications and demonstrate the potential integration of lip print analysis into the country's medico-legal identification system.

Acknowledgment

The authors acknowledge the participation of medical students and support from the institutional ethics committee. Researcher would like to acknowledge the administration of Nepal Medical College for administrative support throughout the study. Researcher also expresses sincere gratitude to NHRC for giving ethical clearance to conduct this study.

References

1. Sivapathasundharam B, Prakash PA, Sivakumar G. Cheiloscopy. Indian J Dent Res. 2001; 12:234-237. PMID: 11824576

2. Sonal V, Nayak CD, Pagare SS. Study of Lip-prints as Aid for Sex determination. *Medico-Legal update*. 2005; 5(3):7-9.
3. Saraswathi TR, Mishra G, Ranganathan K. Study of Lip prints. *J Forensic Dent Sci*. 2009; 1(1):28-31. DOI: [10.4103/0974-2948.50884](https://doi.org/10.4103/0974-2948.50884) PMID: 21189988 PMCID: PMC2994542
4. Suzuki K, Tsuchihashi Y. A new attempt of personal identification by means of lip print. *Can. Soc. Forensic Sci. J*. 1971; 4: 154-158. DOI: [10.1080/00085030.1971.10757287](https://doi.org/10.1080/00085030.1971.10757287)
5. Tsuchihashi Y. Studies on personal identification by means of lip prints. *Forensic Sci*. 1974; 3:233-48. DOI: [10.1016/0300-9432\(74\)90034-X](https://doi.org/10.1016/0300-9432(74)90034-X) PMID: 4858319
6. Aggrawal A. The importance of Lip prints. Dr Anil Aggrawal's forensic files 2004; 2(2). Retrieved on 17.6.2014 from: <http://lifeloom.com/II2Aggrawal.htm>
7. Singh I, Pal GP. *Human Embryology*. 9th Edition. Macmillan Publishers, India. 2012:137-138.
8. Kumar V, Abbas AK, Fausto N. Robbins and Cortan Pathologic Basis of Disease. 7th Edition. p: 471.
9. Sharma P, Saxena S, Rathod V. Cheiloscopy: The study of lip prints in sex identification. *J of Forensic Dent Sci*. 2009; 1(1): 24-27. DOI: [10.4103/0974-2948.50882](https://doi.org/10.4103/0974-2948.50882) PMID: 21189986 PMCID: PMC2994540
10. Sharma P, Saxena S, Rathod V. Comparative reliability of cheiloscopy and palatoscopy in human identification. *Indian J Dent Res*. 2009; 20(4): 453-457. DOI: [10.4103/0970-9290.59449](https://doi.org/10.4103/0970-9290.59449) PMID: 20139580
11. Nagasupriya A, Dhanapal R, Reena K, Saraswathi TR, Ramachandran CR. Patterns - "A crime solver". *J Forensic Dent Sci*. 2011; 3(1): 3-7. DOI: [10.4103/0975-1475.85282](https://doi.org/10.4103/0975-1475.85282) PMID: 22022131 PMCID: PMC3190437
12. Utsuno H, Kanoh T, Tadokoro O, Inoue K. Preliminary study of post mortem identification using Lip prints. *Forensic Science International*. 2005; 149: 129-132. DOI: [10.1016/j.forsciint.2004.11.012](https://doi.org/10.1016/j.forsciint.2004.11.012) PMID: 16226155
13. El Domiaty MA, Al-gaidi SA, Elayat AA, Safwat MD, Galal SA. Morphological patterns of lip prints in Saudi Arabia at Almadinah Almonawarah province. *Forensic Sci Int*. 2010; 200(1-3):179.e1-9. DOI: [10.1016/j.forsciint.2010.04.017](https://doi.org/10.1016/j.forsciint.2010.04.017) PMID: 20471763
14. Sforza C, Grandi G, Binelli M, Dolci C, Menezes DM, Ferrario FV. Age and sex related changes in three dimensional lip morphology. *Forensic science international* 2010; 200:182.e1-182e7. DOI: [10.1016/j.forsciint.2010.04.025](https://doi.org/10.1016/j.forsciint.2010.04.025) PMID: 20494534
15. Dongarwar GR, Bhowate RR, Degwekar SS. Cheiloscopy-Method of Person Identification and Sex Determination. *Open Access Scientific Reports*. 2013; 2(1). DOI: [10.4172/scientificreports.612](https://doi.org/10.4172/scientificreports.612)
16. Murkey PN, Sutay S, Khandekar IL, Tirpude BH, Pawar VG. Cheiloscopy- Everything in nature is unique. *J Indian Acad Forensic Med*. 2008; 30(4):194-197. DOI: [10.1177/0971097320080404](https://doi.org/10.1177/0971097320080404)
17. Gondivkar SM, Indurkar A, Degwekar S, Bhowate R. Cheiloscopy for sex determination. *Journal of Forensic Dental Sciences*. 2009; 1(2):56-60. DOI: [10.4103/0974-2948.60381](https://doi.org/10.4103/0974-2948.60381)
18. Bakshi S, Raman R, Sa PK. Lip Pattern Recognition based on Local Feature Extraction. Accessed on 16.6.2014 from: http://www.researchgate.net/publication/254048341_Lip_pattern_recognition_based_on_local_feature_extraction
19. Kautilya DV, Bodkha P, Rajamohan N. Efficacy of Cheiloscopy in Determination of Sex Among South Indians. *Journal of Clinical and Diagnostic Research*. 2013; 7(10): 2193-2196. DOI: [10.7860/JCDR/2013/6522.3467](https://doi.org/10.7860/JCDR/2013/6522.3467) PMID: 24298479, PMCID: PMC3843478
20. Rao B, Srinivasan SR, Natarajan M. Evaluation and Comparison of Lip Print Patterns Among Indians, Chinese and Malay. *Guident*. 2014; 7(5): 16-18.
21. Kumar GS, Vezhavendhan N, Vendhan P. A study of lip prints among Pondicherry population. *J Forensic Dent Sci*. 2012; 4(2):84-87. DOI: [10.4103/0975-1475.109895](https://doi.org/10.4103/0975-1475.109895) PMID: 23741149 PMCID: PMC3669484
22. Venkatesh R, David MP. Cheiloscopy: An aid for personal identification. *J Forensic Dent Sci*. 2011; 3(2): 67-70. DOI: [10.4103/0975-1475.92147](https://doi.org/10.4103/0975-1475.92147) PMID: 22408323 PMCID: PMC3296377
23. Neo XX, Osman K, Hamzah SPAA, Hamzah NH. Lip Prints in Sex and Race Determination. *Jurnal Sains Kesihatan Malaysia*. 2012; 10 (1): 29-33.
24. Karki RK. Lip Prints -- An Identification Aid. *Kathmandu Univ Med J*. 2012; 10(38):55-7. DOI: [10.3126/kumj.v10i2.7338](https://doi.org/10.3126/kumj.v10i2.7338) PMID: 23132470