Lip print: a humanitarian forensic action[1]

Huella labial: una acción forense humanitaria[1]

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ABSTRACT

Introduction: forensic science involves diverse scientific disciplines that apply their particular expertise to the legal and judicial system. However, in the last decades this science has been linked to humanitarian actions and human rights proceedings. Forensic dentistry plays a vital role in personal identification. The lip print analysis is a relatively a simple procedure used in this discipline. It consists of patterns evaluation of cracks in the elevations and depressions on the labial mucosa. The aim of this study was to determine the lip print patterns of a southern Colombian population in order to add evidence of preconditions for forensic issues as part of a humanitarian forensic action. ***Methods***: a total of 384 participants ≥ 35 years old were included in this study. The lip prints were analyzed through Suzuki and Tsuchihashi's classification in order to identify the predominant lip prints in males and females. Descriptive analysis was used to determine the sample characteristics and a $\chi 2$ test was performed to analyze independence according to sex variable for these categorical data. ***Results:*** the analyses showed that Type I and I' together were the most commonly lip prints seen in this sample, followed by Type II. There were not statistical differences between males and females. ***Conclusions:*** the evaluation of lip prints is a cost-effective method, and it could be an alternative in developing countries, especially in those that address massive violations of human rights.

Keywords: forensic dentistry, lip print, humanitarianism, human rights, epidemiology

RESUMEN

Introducción: la ciencia forense involucra diversas disciplinas científicas que aplican su experiencia particular al ámbito legal y judicial. Sin embargo, en las últimas décadas esta ciencia se ha relacionado con acciones humanitarias y procesos de derechos humanos. La odontología forense juega un papel vital en la identificación personal. El análisis de la huella labial es un procedimiento relativamente sencillo utilizado en esta disciplina. Éste consiste en la evaluación de patrones de fisuras en elevaciones y depresiones de la mucosa labial. El objetivo de este estudio fue determinar patrones de huella labial en una población del sur de Colombia, con el fin de agregar evidencia de precondiciones para problemas forenses como parte de una acción forense humanitaria. ***Métodos:*** en este estudio se incluyó un total de 384 participantes ≥ 35 años. Las huellas labiales se analizaron mediante la clasificación de Suzuki y Tsuchihashi para identificar el predominio en hombres y mujeres. Se utilizó un análisis descriptivo para identificar las características de la muestra y se realizó una prueba de $\chi 2$ para analizar la independencia en la variable sexo para estos datos categóricos. ***Resultados:*** los análisis mostraron que los Tipos I y I' en conjunto fueron las huellas labiales más comunes que se observaron, seguidas del Tipo II. No existieron diferencias estadísticas entre hombres y mujeres. ***Conclusiones:*** la evaluación de las huellas labiales es un método económico y podría ser una alternativa en países en desarrollo, especialmente en aquellos que sustentan violaciones masivas de derechos humanos.

Palabras clave: odontología forense, huella labial, humanitarismo, derechos humanos, epidemiología

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INTRODUCTION

Forensic science involves diverse scientific disciplines that apply their particular expertise to law, enforcement criminal, civil, legal, and judicial matters[1]. It could be considered an integral part of the judicial system because forensic science is one of the primary means through which 'democratic governments fulfill one of the main obligations to their citizens: public safety insurance in a just manner'[2]. However, in the last decades, this science has been linked to humanitarian actions[3] and human rights proceedings.

Since the first resolution adopted in 1992[4], the United Nations (UN) has emphasized that forensic sciences can contribute to the investigation of human rights violations such as people reported missing in armed conflicts, especially those who are victims of serious violations of International Humanitarian Law or Human Rights Law. In this regard, the General Assembly invited all the actors concerned in these situations *"to further their engagement in order to follow forensic best practices as they apply to preventing and resolving cases of missing persons in connection with armed conflict"*[5]. For this purpose, the Committee on Enforced Disappearances, which is the body of independent experts that monitors the implementation of the UN Convention for the protection of all persons from enforced disappearance, has just adopted the Guiding Principles for the Search for Disappeared Persons[6]. These principles aim to serve as guidelines for the consolidation of good international practices on mechanisms, modalities, procedures, and methods to search effectively for missing persons. Principle 7 establish that, when the disappeared person is found dead, *"the search shall be considered as completed when his or her remains have been fully identified and handed over to his or her family members or relatives in a dignified manner"*.

The increasing relevance of these practices that connect human rights and forensic sciences has led to the emergence of a new field: Humanitarian Forensic Action (HFA). This area, which was first used by the International Committee of the Red Cross (ICRC) has been defined as *"the application of the knowledge and skills of forensic medicine and science to humanitarian action, especially following conflicts or disasters"*[7]. The origins of the HFA can be found both in Latin America (mainly in the forensic efforts of searching and identifying the disappeared by Argentine dictatorship) as well as in the broader framework of International Law, through the rules and practices of International Human Rights Law and International Humanitarian Law promoted by the UN or the ICRC[8-10].

Unfortunately, there is no reliable and unified information in Colombia on the total number of disappearances. According to the National Center for Historical Memory, more than 80,000 persons have been reported missing in the country[11]. The Final Peace Agreement between the Government and the Revolutionary Armed Forces of Colombia (FARC-EP) established the basis of a comprehensive system for truth, justice, reparation, and non-repetition[12]. It included a Special Unit for the Search for Persons deemed as Missing, whose objective is to search for the individuals missed in the context of and due to the armed conflict. The Special Unit has joined the already established Commission on the Search for Disappeared Persons and the National Register of Disappeared Persons, among other specific mechanisms. Nonetheless, serious violations of human rights continue in Colombia, including forced disappearances,

with particular concern in the southern part of the territory. One of the novel aspects of the application of HFA in human rights is that forensics could serve, beyond the identification of persons and the collection of evidence, to set up new and more efficient preventive strategies[13]. On this matter, forensic dentistry may assume a new role in human identification for the purpose of preventing human rights violations[14].

Personal identification is based on the comparison of two pieces of information, one known (or *antemortem* in corpses) and other obtained from the victim (or *postmortem* in corpses). A database should be created in the region in order to obtaining these known (or *antemortem*) lip prints from the local population. For this purpose, public policies need to be created and developed. These policies, which must include a personal identification protocol, should create awareness regarding the importance of prevention strategies.

Even though there is no doubt of the role of forensic science in promoting the detection, investigation, and successful prosecution of serious crimes, there are still some gaps. Sometimes, this science does not meet scientific standards of independence and impartiality reporting bias in the published literature[15]. For this reason, using more preconditions for forensic identification in the population could be very useful and appropriate to armed conflicts and transitional justice situations. Forensic dentistry is focused on the assessment of dental evidence to identify an individual, in order to help the authorities to establish the identification of a case[16]. This is evident especially in disasters that include a large number of victims, such as natural catastrophes, victims of violent crimes, or armed conflicts. Furthermore, this branch works on dental records, bite-marks, aging of individuals through dentition, dental/oral injuries to resolve civil issues or criminal matters, and determining dental malpractice complications or negligence situations.

The analysis of lip prints is a procedure that consists of visual inspection of crack patterns created by the elevations and depressions on the labial mucosa surface. The oily and moist secretions from sebaceous and salivary glands located at the vermillion border, and subsequent moisturization from the tongue enables the formation of a latent lip print whenever there is lip contact, leaving behind an important form of transfering evidence[17]. Additionally, lip prints in the same way that finger prints do, may demonstrate that are sufficiently unique to distinguish one person from another, with an insignificant decrease in the recognition accuracy for identical twins[18]. Moreover, lip prints may have a particular repetition pattern in family members, which may help in their hierarchy identification[19]. There are diverse classifications of lip prints; however, the Suzuki and Tsuchihashi's lip prints classification is the most commonly used for recording these patterns[20-24]. It is a relatively straightforward and cost-effective method that could be an alternative in developing countries, especially in those that address massive violations of human rights. Studies related to background origin are important for confirming identification. The aim of this study was to determine the lip patterns of a southern Colombian population in order to add evidence of preconditions methods for forensic issues as part of humanitarian forensic action.

METHODS

Study design, settings, and sample

A cross-sectional study was performed among voluntary participants attending the Dental Clinic at the Universidad Cooperativa de Colombia, Pasto, Colombia. The clinic was opened to the public in 1999. It is a student-run clinic for the attention of individuals of the surrounding and non-surrounding communities, especially those who are unable to access dental care. Annually, around 2,000 adults receive dental treatments in this setting. The Dental Clinic provides services such as screening/diagnosis, preventive and operative dentistry, periodontal treatments, oral rehabilitation, endodontic treatments, extractions, oral surgery, among others.

In order to recruit more adult patients in the Dental Clinic, a probabilistic sample of ≥ 35 years old adults was estimated taking into consideration the 2005 Colombian census, which aimed to cover the population of our municipality as well as all of the regions of the country. This census registered a total of 138,000 people in our city. We calculated a representative sample size for this population at 95% level of confidence with a 5% of margin of accuracy and an expected prevalence of 50%. A sample of 384 individuals was estimated, and sex was taken over a male to female ratio of 1:1. It was recruited from February 2018 to March 2019. This study excluded people who had any type of medical condition with signs of disease in the lips such as sore, bumps, blisters, inflammation, scars, herpes, ulcers, or perioral dermatitis. All volunteers included in this investigation gave written informed consent for their participation in the study.

Measures and procedures

To obtain the lip prints, the lips of the participants were cleaned using wet tissue paper and dried with a facial tissue. A Vogue® dark red colored lipstick (Laboratorio Cosméticos Vogue S.A., Bogotá, Cundinamarca) was applied drawing the lip shape; only one layer of it was spread with a Vogue® eyeshadow brush sponge (Laboratorio Cosméticos Vogue S.A., Bogotá, Cundinamarca) in the participants. The lipstick was removed with Kleenex® (Kimberly-Clark Professional, Dallas, United States) facial tissues or Familia® (Grupo Familia, Medellín, Colombia) wet wipes. Two impressions of the lips were made on a 100 gm Reprograf® white bond paper (Propal Carvajal, Cali, Colombia) when those were required, especially with older participants. Shortly thereafter, all collected samples were covered with a 48mm transparent adhesive tape Jaza Tape® (Intercomercio JAO SAS, Bogotá, Colombia) and some of them were digitally photographed with zoom with Nikon® Camera 4.5-81.0 mm. 18.1 megapixels, OLED 3.0. (Kabushiki-gaisha Nikon; Shinagawa, Tokyo, Japan). The photographs presented in the article were taken by only one researcher, and according to the next standardization: The selected lip prints were placed over a table that was close to a window side, they were taken in the morning between 9-10 a.m. with natural daylight, the camera flash was disabled, and the distance used between the lip prints and the camera lense was 10.2 cm.

The impressions were analyzed using a JD-01Y LED® dental negatoscope (viewing area: 350×150mm) (Changsha Jinde Technology Co., Ltd., Hunan, China). The samples were classified as Type I, Type I', Type II, Type III, Type IV, or Type V according to the Suzuki and

Tsuchihashi's classification[25]. Briefly, the criteria of this classification was as follows: Type I, clear cut grooves running vertically across the lips; Type I', straight grooves which disappear halfway instead of covering the entire lip; Type II, fork grooves in their course; Type III, intersecting grooves; Type IV, reticulate grooves and Type V, undetermined (Figure 1).

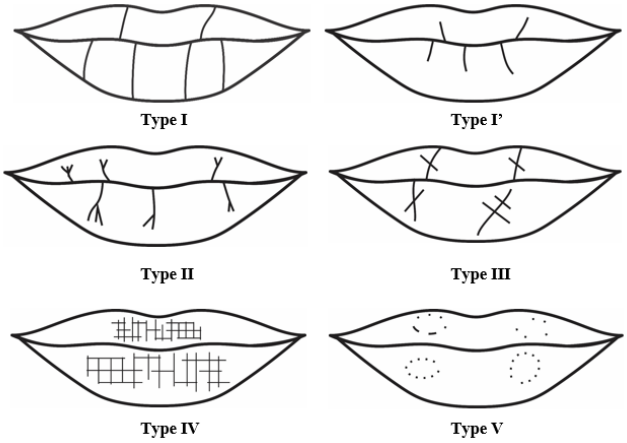

Figure 1. Suzuki and Tsuchihashi's classification of the lip prints

Source: by the authors

One trained and calibrated examiner conducted all lip prints' categorizations. After studying lip morphology, cartoons, and photographs of the Suzuki and Tsuchihashi's classification, the evaluador assessed around 10% of the sample (40 cases). The time interval between the 1st and 2nd evaluation was one-week. When there was a disagreement, the examiner studied the case and re-assessed the lip print. The intra-examiner Cohen's Kappa index was 0.74; $P<0.001$. These participants' lip prints were included in the whole sample since the index obtained was interpreted as "substantial"[26].

Additional information on demographic characteristics was obtained. These included age of the participants [measured in years and classified in four groups (35-44 years), (45-54 years), (55-64 years) and ≥ 65 years]; sex [coded as male and female according to World Health Organization definition][27]; socioeconomic status [classified according to criteria based on housing quality indicators set by the Colombian government as low, middle and high].

Statistical analysis

Descriptive analysis was used to determine the sample characteristics, and a χ^2 test was calculated to analyze independence between males and females for these categorical data. There were no missing data. The level of significance was set at $P<0.05$. Data were analyzed using SPSS software version 25 (IBM SPSS Statistics, Armonk, New York, USA).

Ethics

The research protocol was approved by the Universidad Cooperativa de Colombia, Bioethics Subcommittee (Act No. SCBE09-17, 15/06/17).

RESULTS

A total of 384 participants were enrolled in this study. About two-thirds of the individuals were females (male/female ratio was 1:2.3). Table 1 describes the sample distribution according to the socio-demographic characteristics (age, sex and socio-economic status). There was a higher frequency of people in the age-group of 35-44 as compared to the 55-64 and ≥65 years-old groups (*P*=0.031).

Type I and I' (48.7%) were the most commonly lip prints seen in this sample, followed by Type II (26.0%). Males presented more frequently the Type I' (30.8%) while females the Type II (28.5%) classification; however, the observed difference was not statistically significant (Table 2).

Table 1. Socio-demographic characteristics of the 384 individuals from Pasto, Colombia

Variables	Total (*n* = 384) 100%		Males (*n* = 117) 30.5%		Females (*n* = 267) 69.5%		*P* value[a]
	n	%	n	%	n	%	
Age							
35-44 yrs	164	42.7	50	42.7	114	42.7	
45-54 yrs	140	36.5	34	29.1	106	39.7	0.031
55-64 yrs	68	17.7	26	22.2	42	15.7	
≥65 yrs	12	3.1	7	6.0	5	1.9	
Socioeconomic status							
Low	310	80.7	92	78.6	218	81.6	
Middle	67	17.5	21	17.9	46	17.3	0.291
High	7	1.8	4	3.5	3	1.1	

[a]*P* values were derived from χ2 tests

Source: by the authors

Table 2. Patterns of lip prints according to Suzuki and Tsuchihashi's classification

Types	Total (*n* = 384) 100%		Males (*n* = 117) 30.5%		Females (*n* = 267) 69.5%	
	n	%	n	%	n	%
Type I	93	24.2	27	23.1	66	24.7
Type I'	94	24.5	36	30.8	58	21.7
Type II	100	26.0	24	20.5	76	28.5
Type III	19	4.9	2	1.7	17	6.4
Type IV	50	13.0	19	16.2	31	11.6
Type V	28	7.4	9	7.7	19	7.1

P = 0.083, derived from χ2 test.

Source: by the authors

In figure 2 we showed some frequent lip prints patterns in our community, which were obtained from the lipstick marks.

Figure 2. Lip prints observed in a southern Colombian population by sex

A. Female's lip print Type I; B. Male's lip print Type II

Source: by the authors

DISCUSSION

The purpose of this research was to analyze lip prints of a southern Colombian population in order to identify patterns for forensic identification. Cheiloscopy (from the Greek language *cheilos*: lips & skopein: see) is a forensic research technique that evaluate traces of the lips[28]. It is possible to identify lip patterns as early as the sixth week of intrauterine life. Subsequently, lip groove patterns rarely change[29], resisting many afflictions[30]. The imprint of the lips can be found on the surface of the cups, glasses, cigarette butts, doors, plastic bags, or in natural disasters or armed conflicts directly on faces. Sometimes, they may be less exposed to physical damage than fingerprints. Finding lip prints is not difficult.

According to Susuki and Tsuchihashi's classification[25], Type I (I and I') was the most popular mark in this sample. This finding was similar to the reported in the studies conducted by Venkatesh and David[31] in Karnataka; by Thermadam et al.[32] in Calicut (Kerala); by Alzapur et al.[24] in Telangana, by Kapoor and Badiye in Maharashtra (Marathi)[22], and by Kaul et al.[33] in an study carried out in Indian population. However, our results are different from those observed by Sharma et al.[34] in men of Kadrabad (Monidagar), India and by Abdel Aziz et al.[35], and in Egyptian and Malaysian populations where Type III pattern was the most predominant. In addition, our results were different to those found by Šimović et al.[36] in an study from Croatia, in which Type II was the most frequent.

Interestingly, a lip print may be a more important identification tool for females than males. In our research, they accepted to use a lipstick more easily than men did. For that reason, the sex ratio of male/female participation was 1:2.3 instead of 1:1 according to our probabilistic sample. Regarding masculinity characteristics, men often *"prefer to risk their physical health and well-being rather than be associated with traits they or others may perceive as feminine"*[37]. One solution to this problem would be to change the color of lipstick (e.g. black). But, if males attitude persists, lip prints could very useful to identify females, as a way to respect social practices and cultural beliefs. Unfortunately, Colombia has high rates of violence against women[38]. Cases of domestic and sexual violence, as well as, disappearances and kidnappings, are especially serious and frequent. Besides, cases related to drug trafficking, prostitution, and human trafficking can constantly be observed (young girls and adolescents are mainly affected by these forms of violence). Therefore, a gender-based approach seems to be necessary and relevant in the region. The difference in participation between males and females may not necessarily be a problem in a future.

Forensic dentistry may play a vital role in the detection and resolution of personal identification in the context of massive human rights violations and armed conflicts. Since determining the identity of a missing person could be a very difficult procedure, using more preconditions such as lip prints would contribute to improve the identification process. Moreover, it is the least invasive, cost-effective, and a relatively simple procedure among all human identification methods that could be very useful in developing countries and transitional justice societies such as Colombia, especially in villages where technology and information systems are scarce. Furthermore in recent times, experts have highlighted this technique as a preventive approach. It is more difficult to have crimes unpunished if the number of evidences increase. Even though creating a lip print database could be a challenge, the inclusion of dental professionals working for public health clinical centers from confict zones in rural areas, could be a proper solution. It implies that these professionals, which traditionally are not involved in the construction of peace, justice and promotion of human rights could participate in these issues. Due to of the mentioned above, we consider that Colombian public institutions will benefit greatly from this method.

We have some limitations in this study. For example, our sample was not randomized and we analyzed voluntary consecutive cases which are subject to inaccuracies and bias. Therefore, the results should be interpreted with caution. The gender issues also may influence the proportion of the classifications in males. Our comparisons may be inconsistent since some of the studies we quoted had small samples (no more than 200 individuals). Additionally, comparison with other Latinoamerican studies was limitated because those studies were different to this investigation in relation to the methods used, for example, the lip prints' classification[39] as well as the inclusion of very small samples[40]. Further research is required to provide high quality evidence about lip prints in different locations.

CONCLUSIONS

The evaluation of lip prints is a cost-effective method that could be an alternative for identification of individuals in developing countries, especially in those that address massive violations of human rights.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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REFERENCES

1. Prahlow JA. Forensic pathology for police, death investigators, attorneys, and forensic scientists. New York: Springer; 2010.
2. Houck MM, Siegel JA. Fundamentals of Forensic Science. Boston: Academic Press; 2006.
3. Kirschner RH, Hannibal KE. The application of the forensic sciences to human rights investigations. Med Law. 1994; 13(5-6): 451-60.
4. UN Commission on Human Rights. Human rights and forensic science. Report E/1992/22-E/CN.4/1992/84 (28-02-1992).
5. UN General Assembly. Missing persons. Resolution A/RES/71/201 (19-12-2016).
6. Committee on Enforced Disappearances. Guiding principles for the search for the disappeared persons. (16-04-2019).

7. Cordner S, Tidball-Binz M. Humanitarian forensic action: its origins and future. Forensic Sci Int. 2017; 279: 65-71. DOI: https://doi.org/10.1016/j.forsciint.2017.08.011

8. Tidball-Binz MV, Hofmeister U. Forensic archaeology in humanitarian contexts: ICRC action and recommendations. In: Groen WJM, Márquez-Grant N, Janaway RC (eds). Forensic Archaeology: a global perspective. Hoboken (NJ): John Wiley & Sons Ltd.; 2015: pp.427–37.

9. Gaggioli G. International humanitarian law: the legal framework for humanitarian forensic action. Forensic Sci Int. 2018; 282: 184-94. DOI: https://doi.org/10.1016/j.forsciint.2017.10.035

10. Cordner S. Humanitarian forensic science. Aust J Forensic Sci. 2018; 50(6): 639-50. DOI: https://doi.org/10.1080/00450618.2018.1461930

11. Colombia. Centro Nacional de Memoria Histórica. Observatorio de memoria y conflicto [Internet]. Bogotá; 2018 [Access date: January, 20, 2019] Available at: http://centrodememoriahistorica.gov.co/observatorio

12. The University of Edinburgh. Final agreetment to end the armed conflict & build a stable and lasting peace [Internet]. Scotland; 2016 [Access date: June, 7, 2019] Available at: https://www.peaceagreements.org/generateAgreementPDF/1845

13. Vieira DN. Humanitarian Forensic Action. A New Field of Application for Forensic Sciences. In: Ferrara SD. (ed). P5 Medicine and Justice. Innovation, Unitariness and Evidence. Cham, Switzerland: Springer; 2017: 182-89.

14. Smitha T, Sheethal HS, Hema KN, Franklin R. Forensic odontology as a humanitarian tool. J Oral Maxillofac Pathol. 2019; 23:164. DOI: https://dx.doi.org/10.4103%2Fjomfp.JOMFP_249_18

15. Roberts P. Paradigms of forensic science and legal process: a critical diagnosis. Philos Trans R Soc Lond B Biol Sci. 2015; 370(1674): 20140256. DOI: https://doi.org/10.1098/rstb.2014.0256

16. Sloan AJ. Development of the dentition. In: Adams C, Carabott R, Evans S. (eds). Forensic odontology: an essential guide. New Jersey: John Wiley & Sons, Ltd; 2014: 9-21.

17. Ahmed SA, Salem HE, Fawzy MM. Forensic dissection of lip print as an investigative tool in a mixed Egyptian population. Alex J Med. 2018; 54(3): 235–39. DOI: https://doi.org/10.1016/j.ajme.2017.08.002

18. Han Y, Ryu C, Moon J, Kim H, Choi H. A Study on evaluating the uniqueness of fingerprints using statistical analysis. In: Park C., Chee S. (eds). Information Security and Cryptology – ICISC 2004. Lecture Notes in Computer Science, vol. 3506. Springer: Berlin, Heidelberg; 2015.

19. Mala S, Rathod V, Pundir S, Dixit S. Pattern self-repetition of fingerprints, lip prints, and palatal rugae among three generations of family: a forensic approach to identify family hierarchy. J Forensic Dent Sci. 2017; 9(1): 15-9. DOI: https://dx.doi.org/10.4103%2Fjfo.jfds_115_15

20. Tandon A, Srivastava A, Jaiswal R, Patidar M, Khare A. Estimation of gender using cheiloscopy and dermatoglyphics. Natl J Maxillofac Surg. 2017; 8(2): 102-5. DOI: https://dx.doi.org/10.4103%2Fnjms.NJMS_2_17

21. 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. DOI: https://doi.org/10.5644/ama2006-124.195

22. Kapoor N, Badiye A. A study of distribution, sex differences and stability of lip print patterns in an Indian population. Saudi J Biol Sci. 2017; 24(6): 1149-54. DOI: https://dx.doi.org/10.1016%2Fj.sjbs.2015.01.014

23. Khanapure S, Suhas HG, Potdar S, Sam G, Sudeep CB, Arjun MR. Association between cheiloscopic patterns and ABO blood groups among South Indian population. J Contemp Dent Pract. 2017; 18(7): 596-600. DOI: https://doi.org/10.5005/jp-journals-10024-2091

24. Alzapur A, Nagothu RS, Nalluri HB. Lip prints: a study of its uniqueness among students of MediCiti Medical College. Indian J Clin Anat Physiol. 2017; 4(1): 68-70.

25. Suzuki K, Tsuchihashi Y. New attempt of personal identification by means of lip print. J Indian Dent Assoc. 1970; 42(1): 8-9.

26. McHugh ML. Interrater reliability: the kappa statistic. Biochem Med (Zagreb). 2012; 22(3): 276-82.

27. World Health Organization. Gender and health [Internet]; 2020 [Access date: February, 20, 2020]. Available at: https://www.who.int/news-room/q-a-detail/gender-and-health

28. Dineshshankar J, Ganapathi N, Yoithapprabhunath TR, Maheswaran T, Kumar MS, Aravindhan R. Lip prints: role in forensic odontology. J Pharm Bioallied Sci. 2013; 5(Suppl 1): S95-7. DOI: https://dx.doi.org/10.4103%2F0975-7406.113305

29. Eldomiaty MA, Anwar RI, Algaidi SA. Stability of lip-print patterns: a longitudinal study of Saudi females. J Forensic Leg Med. 2014; 22: 154-8. DOI: https://doi.org/10.1016/j.jflm.2013.12.011

30. Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci. 1974; 3(3): 233-48. DOI: https://doi.org/10.1016/0300-9432(74)90034-x

31. Venkatesh R, David MP. Cheiloscopy: an aid for personal identification. J Forensic Dent Sci. 2011; 3(2): 67–70. DOI: https://doi.org/10.4103/0975-1475.92147

32. Thermadam TP, Chatra L, Ahsan A. Cheiloscopy in gender determination: a study on 2112 individuals. J Family Med Prim Care. 2020; 9(3): 1386-90. DOI: https://doi.org/10.4103/jfmpc.jfmpc_1046_19

33. Kaul R, Shilpa PS, Padmashree S, Bhat S, Sultana N. Study of lip prints in different ethno-racial groups in India. Indian J Dent Res. 2017; 28(5): 545-48. DOI: https://doi.org/10.4103/ijdr.IJDR_352_14

34. Sharma BS, Gupta V, Vij H, Sharma E, Tyagi N, Singh S. Cheiloscopy: a tool for antemortem identification. Indian J Dent Sci. 2017; 9(3): 176-80. DOI: https://doi.org/10.4103/IJDS.IJDS_60_17

35. Abdel-Aziz MH, Badr-El Dine FMM, Saeed NMM. Regression equations for sex and population detection using the lip print pattern among Egyptian and Malaysian adult. J Forensic Leg Med. 2016; 44: 103-10. DOI: https://doi.org/10.1016/j.jflm.2016.10.003

36. Šimović M, Pavušk I, Muhasilović S, Vodanović M. Morphologic patterns of lip prints in a sample of Croatian population. Acta Stomatol Croat. 2016; 50(2): 122-7. DOI: https://doi.org/10.1564/asc50/2/4

37. Evans J, Frank B, Oliffe JL, Gregory D. Health, illness, men and masculinities (HIMM): a theoretical framework for understanding men and their health. J Mens Health. 2011; 8(1): 7–15. DOI: https://doi.org/10.1016/j.jomh.2010.09.227

38. UN Women. Global database on violence against women [Internet]; 2016 [Access date: March, 09, 2021] Available at: https://bit.ly/3z53ozw

39. Fallas-Morales L, Corrales-Solís AL, Fernández-Chaves JM. Análisis de huellas labiales en una muestra de estudiantes de odontología de la Universidad de Costa Rica mediante la clasificación de Renaud: estudio piloto. Med Leg Costa Rica. 2018; 35(2): 20-37.

40. Mantilla-Hernández JC, Otero-Pabón YL, Martínez-Paredes JF. Identificación de sexo mediante queiloscopia en Santander, Colombia: una herramienta para la medicina forense. Estudio inicial. Rev Esp Med Legal. 2015; 41(3): 111-16. DOI: http://dx.doi.org/10.1016/j.reml.2015.05.004