www.jchr.org

JCHR (2024) 14(3), 1033-1038 | ISSN:2251-6727



Accepted: 08 April 2024)

Cheiloscopy and Rugoscopy: A Scientific Approach for Sex Determination.

¹Deepankar Misra, ²Mukul Prabhat, ³Akansha Budakoti, ⁴Vashishtha Singh, ⁵Chhavi Srivastava, ⁶Manish Singh Prayasi,

¹Professor and Head, Department of Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Kadrabad, Modinagar, Ghaziabad (U.P.)

²Reader, Department of Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Kadrabad, Modinagar, Ghaziabad (U.P.)

³Reader, Department of Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Kadrabad, Modinagar, Ghaziabad (U.P.)

⁴Senior Lecturer, Department of Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Modinagar, Ghaziabad, (U.P.)

⁵Senior Lecturer, Department of Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Modinagar, Ghaziabad, (U.P.)

⁶Post Graduate Student, Department of Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Modinagar, Ghaziabad, (U.P.)

Revised: 11 March 2024

(Received: 04 February 2024

KEYWORDS	ABSTRACT:
Forensic dentistry, Human identificat ion, Lip prints, Cheilosco py, Palatal rugae.	Introduction : The major areas of forensic dentistry include determining a patient's gender, age, race, and size as well as gathering dental evidence and reconstructing a patient's face over skeletal remains. Lip prints are said to be unique to a person and similar to fingerprints. The palatal rugae pattern has been regarded as one of the pertinent indicators for human identification in the field of forensic medicine because of its stability and uniqueness.
	Objectives : To evaluate the effectiveness of palatal rugae pattern and lip prints for gender distinction and human identification. The objectives of the study were to distinguish between male and female lip prints and palatal rugae based on gender.
	Methods : Subjects were randomly chosen from the OPD and an informed consent was obtained. Study was performed on 136 subjects equally divided into two groups according to gender. For rugoscopy all the dental casts were collected, duplicated and later analyzed. The legal age of the subject was confirmed using the case history proforma of the patients submitted along with the casts. The relevant demographic data including name, age, sex, address as well as findings from clinical examination were recorded for each selected individual in a specially designed Proforma.
	Results : Considering both the lips, type V pattern was most predominant pattern in males followed by type III while type I pattern was most predominant pattern in females followed by type I. Predominant shape of rugae in females is wavy followed by curved and straight and in males is curved followed by wavy, straight and unification.
	Conclusions : Both cheiloscopy and rugoscopy have the potential to identify an individual also lip prints are more reliable in identifying the sex of an individual as compared to palatal rugae patterns.

www.jchr.org

JCHR (2024) 14(3), 1033-1038 | ISSN:2251-6727



1. Introduction

Determining a person's identification by skeletal and dental characteristics yields extensive information and persuasive proof that is crucial for regular forensic investigations.^{1,2} Forensic odontology deals with the proper handling and examination of dental evidence and evaluation and presentation of dental findings.^{3,4}

Human identification is one of the principal areas of research in forensic science and can be accomplished by determining patient's gender, age and race. Comparative identification and reconstructive identification are common methods.^{4,5,6,7}

Even though standard methods like DNA profiling, finger prints, anthropometric data, and dental records can be used, there are times when it makes sense to use some of the less common and uncommon ancillary methods, like cheiloscopy, palatoscopy, and other odontometric measurements, which, when carried out, yield relatively reliable results.⁵

Study of these lip prints and palatal rugae are respectively known as cheiloscopy and rugoscopy. These anatomical structures are said to be unique to a person. Lip prints develop during sixth week, whereas rugae develop during the third month of intrauterine life.^{6,7}

Lip prints seldom alter in pattern and can withstand a variety of pathological conditions, however, palatal rugae are protected by lips, cheeks, tongue, teeth, and bone thus making them stable in position and shape, with the exception of length changes caused by growing.^{4,8}

Both lip prints and rugae pattern can be directly or indirectly recorded at a crime scene.^{7,8} Lip prints and palatal rugae patterns are distinctive personal traits that, in forensic odontology, can lead to crucial information and aid in the identification of an individual. Nevertheless, there aren't many examples that compare the accuracy of rugoscopy with cheiloscopy for identifying people.^{5,6} Therefore, the study's objective was to evaluate the validity of palatal rugae pattern and lip prints for gender identification.

2. Objectives

The objectives of the study is to ascertain how lip prints are used to identify people, to distinguish between male and female lip prints based on gender, to identify the palatal rugae pattern in humans, to compare the patterns of palatal rugae in males and females in order to distinguish between genders and to assess how reliable palatal rugae patterns and lip prints are for identifying people and separating genders.

3. Methods

A total of 136 subjects were randomly selected from the outpatient department of Oral Medicine & Radiology and a detailed case history proforma was filled. The subjects were equally divided into two groups according to gender. The gender of an individual was blinded for the study. An informed consent was obtained from every patient. Inclusion criteria included participants in good health and had not undergone any orthodontic treatment, or suffering from any inflammation, trauma, or congenital anomalies involving lips or palate. Those with lip or palatal lesions, cleft lips/palate, history of plastic or reconstructive surgery, and hypersensitivity to lip sticks and dental materials were excluded from the study. The study protocol was approved by of Institutional Ethical committee.

For cheiloscopy, lipstick was applied using applicator brushes, which was applied at the midline and proceeding laterally. To distribute the lip stick uniformly, the subjects were instructed to rub both lips. After letting the lipstick dry for roughly two minutes, lip prints were captured. Scotch MagicTM tape was used to take individual lip prints. These prints were adhered to white paper using a technique akin to that expounded by Sivapathasundharam et al. Each person's lip prints were digitized at a resolution of 600 ppi using an image scanner. The pictures were scanned in grayscale after being inverted. For optimal detail, they were saved as TIFF (Tagged Image File Format) files. As recommended by Augustine et al., the most readable prints of each lips taken separately were cropped, and vertical lines were made to divide the lips into three pieces using Adobe® Photoshop® 7.0 software. Lip prints was classified according to the Suzuki and Tsuchihashi (1970).⁹ The data obtained from various measurements was recorded on the proforma.

For rugoscopy high quality alginate impressions were made of maxillary arch and dental casts were obtained using Dental stone (Gypsum Type 4). A pointed graphite pencil was used in sufficient light to trace the

www.jchr.org

JCHR (2024) 14(3), 1033-1038 | ISSN:2251-6727



outline of rugae on casts. The magnifying glass was used to examine the palatal rugae pattern. Modified Lysell classification was used to do the analysis.¹⁰ Based on their shape, the rugae were classified into four categories. The rugae pattern was categorized as straight if it ran straight from the origin to the termination, circular if it formed a distinct continuous ring, wavy if it was slightly curved at the origin and termination, and undetermined if it did not fit into any of the aforementioned categories.

Statistical anaylsis was performed using the Statistical Package for Social Sciences (SPSS) version 16 and Epi Info version 6.0. Paired, Unpaired t- test, ANOVA, Chi-Squrae test and Pearson's correlation coefficient tests was used to determine the various parameters.

4. Results

The present study was done on 136 subjects (age above the 18 years) of both genders (68 males and 68 females). Table 1 shows predominant pattern of lip print in males and females. Type V pattern was most predominant in 36 (52.94%) males and Type I and I' was least common in 1 (1.47%) males respectively. Type I pattern was most predominant in 32(47.06%) females and none of the females showed type III and type V pattern. The results were statistically highly significant for type I, type I', type II and type V patterns (p<0.01).

Table 2 shows predominant pattern of rugae in males and females. Curved pattern was most predominant in 32(47.06%) males and unification was least common in 1(1.47%) male. Wavy pattern was most predominant in 42 (61.76\%) females and none of the females showed unification pattern. The results were statistically highly significant for type I, type I', type II and type V patterns (p<0.01). A highly significant difference was found for curved pattern (p<0.01) and significant difference for wavy pattern (p<0.05) were found.

Table 3 shows distribution of total number of primary rugae in males and females. The mean number of primary rugae in male was $7.85(\pm 1.91)$ and in female it was $8.31(\pm 1.62)$. However, the results were non significant.

5. Discussion

In the current study, we sought to determine the differences in lip and rugae patterns as well as the relative validity of palatal rugae patterns and lip prints for gender differentiation and human identity in 136 participants. Similar studies have been previously reported in literature.^{11,12,13,14,15} A small number of scholars have split each lip print into the central section, left lateral, and right lateral.^{12,13} Few studies have focused on the 10 mm-wide central region of the lower lip as done in our study.^{14,15} Additionally, Vanguru et al $(2023)^{16}$ separated lip prints into eight quadrants. The midline of the lip print was used to split it into two quadrants, each of which was then further separated into equal sections called medial and lateral. In this study the lip prints were categorized following the scheme Suzuki and Tsuchihashi published in 1970.

Researchers have previously studied lip prints to demonstrate that there is a gender difference in lip prints. The results in the current study showed a predominance of the type I pattern was seen in males. The results results of this study was not in accordance with previous report by Manikya S et al (2018) where Type I and type I patterns were shown to be dominant in females, but type II and type IV patterns were prominent in men.¹⁷ Another research by Uzomba GC et al $(2023)^{18}$ revealed that male participants had distinct patterns whereas all four quadrants with the same type of lip prints were more common in female subjects. Six variations of type V patterns have been described by Vitosyte M et al (2023).¹⁹ These include "cartwheel appearance", "pineapple skin appearance", "trifurcation", "bridge or "H"pattern", "horizontal lines" and "multiple branching appearances." Uzomba GC et al (2023)18 have depicted "circular shaped area with minute dots,""oval shaped area with horizontal lines," and "small leaf like structure with central line and branching lines" among others. people categorized as type V. In the current study no further classification of Type V was done.

While analyzing palatal rugae patterns, no significant difference was found in the total number of primary rugae and length of primary rugae in males and females, reinforcing the fact described by other researchers.^{20,21} But, few studies revealed that males showed a higher in total number of primary rugae.^{22,23,24}

www.jchr.org

JCHR (2024) 14(3), 1033-1038 | ISSN:2251-6727



Thus it can be put forth that lip prints and rugae pattern can act not only as a means of identifying individuals but they also have a high rate of accuracy in gender determination. But they have a major drawback too, as lips and rugae are soft tissue structures they are prone to changes post mortem and can also be injured in course of accidents etc. Very little data base is available on lip prints and rugae worldwide right now as the major emphasis is on structures which tend to remain stable postmortem. Lip prints and rugae pattern though may not be very valuable in cases of mass disasters where the body is mutilated or decomposed these can be very valuable in cases where both the victims and suspected perpetrators can be examined soon after the incident.

In conclusion, the study proves that both cheiloscopy and rugoscopy have the potential to identify an individual also lip prints are more reliable in identifying the sex of an individual as compared to palatal rugae patterns. Thus, lip prints and palatal rugae hold potential as a supplementary tool, along with the dentition, to establish the identity of an individual. Nevertheless, the larger samples should be examined in detail to further validate the findings of this study and come to definitive conclusions.

Refrences

- Kumar N, Sarvathikari R, Jayaraman V, Mathew P, Jyotsana K. Palatal rugae as an unique and stable marker in personal identification-An interracial pilot study. Indian J Dent Res. 2023 Apr-Jun;34(2):187-190.
- Sharma P, Saxena S, Rathod V. Comparative reliability of cheiloscopy and palatoscopy in human identification. Indian J Dent Res. 2009 Oct-Dec;20(4):453-7.
- Jeddy N, Ravi S, Radhika T. Current trends in forensic odontology. J Forensic Dent Sci. 2017 Sep-Dec;9(3):115-119.
- 4. Gautam N, Patil SG, Krishna RG, Agastya H, Mushtaq L, Kumar KV. Association of Palatal

Rugae Pattern in Gender Identification: An Exploratory Study. J Contemp Dent Pract. 2017 Jun 1;18(6):470-473.

- Thabitha RS, Reddy RE, Manjula M, Sreelakshmi N, Rajesh A, Kumar VL. Evaluation of palatal rugae pattern in establishing identification and sex determination in Nalgonda children. J Forensic Dent Sci. 2015 Sep-Dec;7(3):232-7.
- V N, Ugrappa S, M NJ, Ch L, Maloth KN, Kodangal S. Cheiloscopy, Palatoscopy and Odontometrics in Sex Prediction and Discrimination - a Comparative Study. Open Dent J. 2015 Jan 6;8:269-79.
- Mutalik VS, Menon A, Jayalakshmi N, Kamath A, Raghu AR. Utility of cheiloscopy, rugoscopy, and dactyloscopy for human identification in a defined cohort. J Forensic Dent Sci. 2013 Jan;5(1):2-6.
- Shetty D, Juneja A, Jain A, Khanna KS, Pruthi N, Gupta A, Chowdhary M. Assessment of palatal rugae pattern and their reproducibility for application in forensic analysis. J Forensic Dent Sci. 2013 Jul;5(2):106-9.
- 9. Suzuki K, Tsuchihashi Y. New attempt of personal identification by means of lip print. J Indian Dent Assoc. 1970 Jan;42(1):8-9.
- Chaves T, Azevedo Á, Caldas IM. Cheiloscopy in sex estimation: a systematic review. Forensic Sci Med Pathol. 2023 May 27.
- Navit S, Pramanik S, Khan SA, Jabeen S, Grover N, Bharti A. Cheiloscopy and Dactyloscopy as Behavior Assessment Tool in Dental Settings: A Cross-sectional Study. Int J Clin Pediatr Dent. 2021 Mar-Apr;14(2):238-242.
- Vatchala Rani RM, Jeergal VA, Jeergal PA, Gami KS, Mankar S, Mankar S. Lip Prints and Dermal Prints as a Tool to Detect the Skeletal Malocclusion: A Clinical Study. J Pharm Bioallied Sci. 2022 Jul;14(Suppl 1):S888-S892.
- 13. Abdul NS, Alotaibi SZ, Almughalliq FA, Alamri MD, Alshahrani RA, Almujalli AI. Α Questionnaire-Based Study to Assess Knowledge and Awareness Regarding Cheiloscopy as a Forensic Odontology Diagnostic Tool Among Professionals. Cureus. 2022 Nov Dental 7;14(11):e31188.
- 14. Abidullah M. Triad of Cheiloscopy, Dactyloscopy, and Blood Groups: Does it Signify Anything? J

www.jchr.org

JCHR (2024) 14(3), 1033-1038 | ISSN:2251-6727

Pharm Bioallied Sci. 2023 Jul;15(Suppl 1):S27-S30.

- 15. Bhattacharjee R, Kar AK. Cheiloscopy: A crucial technique in forensics for personal identification and its admissibility in the Court of Justice. Morphologie. 2023 Oct 25;108(360):100701.
- Vanguru R, Pasupuleti S, Manyam R, Supriya AN, Shrishail BS, Yoithapprabhunath TR. Analysis of Inheritance patterns, gender dimorphism and their correlation in lip and palm prints - A crosssectional study. J Oral Maxillofac Pathol. 2023 Jan-Mar;27(1):130-137.
- Manikya S, Sureka V, Prasanna MD, Ealla K, Reddy S, Bindu PS. Comparison of Cheiloscopy and Rugoscopy in Karnataka, Kerala, and Manipuri Population. J Int Soc Prev Community Dent. 2018 Sep-Oct;8(5):439-445.
- Uzomba GC, Obijindu CA, Ezemagu UK. Considering the lip print patterns of Ibo and Hausa Ethnic groups of Nigeria: checking the wave of ethnically driven terrorism. Crime Sci. 2023;12(1):4.
- Vitosyte M, Malinauskaite D, Chalas R, Brukiene V, Lasota A, Puriene A. Lip morphometry and morphologic pattern variation by ethnicity. Anthropol Anz. 2023 Jan 18;80(1):13-21.
- 20. Kulkarni S P, Badole S M, Wasekar R R, Ullah F A T, Mandibular canine index, palatine rugae pattern

and cheiloscopy as a predictor in sex determination: A Comparative Study. Int J Oral Health Dent 2016;2(3):154-160.

- 21. Sharma T, Chaitan SM, Somayaji NS, Mahajan B, Rajguru JP, Hajibabaei S, Hegde S. The medicolegal importance of establishing human identity by using dactyloscopy and rugoscopy: A comparative study. J Family Med Prim Care. 2020 Jul 30;9(7):3236-3241.
- Gupta V, Kaur A. Palatal rugoscopy as an adjunct for sex determination in forensic odontology (Sri Ganganagar population): A cross-sectional study of 100 subjects. J Oral Maxillofac Pathol. 2021 Sep-Dec;25(3):556.
- 23. Farronato M, Begnoni G, Boodt L, Thevissen P, Willems G, Cadenas de Llano-Pérula M. Are palatal rugae reliable markers for 3D superimposition and forensic human identification after palatal expansion? A systematic review. Forensic Sci Int. 2023 Oct;351:111814.
- Alshammari A, Farook FF, Alyahya L, Alharbi M, Alazaz NN, AlKadi L, Albalawi F, Aboalela A. A Morphometric Analysis of Palatal Rugae Patterns in a Saudi Arabian Population. Cureus. 2022 Dec 28;14(12):e33058.

Predominant pattern of	Gender			
lip print	Male (%)(n=68)	Female (%) (n=68)	P value	
I	1(1.47)	32(47.06)	<0.01	
Ι'	1(1.47)	27(39.70)	<0.01	
П	7(10.29)	9(13.23)	>0.05	
Ш	19 (27.94)	0 (0.0)	<0.01	
IV	6(8.82)	3 (4.41)	>0.05	
V	36(52.94)	0 (0.0)	<0.01	

Table 1: Genderwise predominant pattern of lip print



www.jchr.org

JCHR (2024) 14(3), 1033-1038 | ISSN:2251-6727



Table 2 : Genderwise predominant shape of rugae

Predominant shane of	Gender		
rugae	Male(%)(n=68)	Female(%)(n=68)	P value
Curved	32(47.06)	14(20.59)	<0.01
Wavy	29(42.65)	42(61.76)	< 0.05
Straight	11(16.17)	12(17.65)	>0.05
Unification	1(1.47)	0 (0.0)	>0.05

Table 3: Distribution of total number of primary rugae in males and females

Gender	N	Mean	SD	Mean Difference	95%Cl of the Mean difference		P value
					Lower	Upper	
Male	68	7.85	1.91	-0.46	-1.06	0.14	>0.05
Female	68	8.31	1.62				