

Original Article

ESTABLISHING RELATIONSHIP BETWEEN RUGOSCOPY AND CHEILOSCOPY IN PEDIATRIC POPULATION: A CROSS-SECTIONAL STUDY IN CENTRAL INDIA

Priyanka Mali¹, Sahana S², Minti Kumari³

¹ Private Practitioner, Bhopal

² Professor and Head, Public Health Dentistry, Patna Dental College and Hospital

³ Professor and Head, Public Health Dentistry, Patna Dental College and Hospital

Abstract:

Introduction: Rugoscopy is the examination of palatal rugae patterns, whereas cheiloscropy is the forensic investigation technique for examining lip impressions. The palatine rugae and lip impressions are distinguishing anatomical characteristics that are specific to every person and can be utilised effectively for human identification.

Aim: The purpose of this investigation is to establish a relationship between rugoscopic and cheiloscopic patterns in minors.

Materials and methods: A descriptive involving 100 subjects aged 5 to 15 years was conducted. Rugae patterns and lip impressions were analysed and recorded. The Lysell classification (1955) and the Thomas and Kotze classification (1983) evaluate rugoscopic patterns based on their length and their shape and cohesion, respectively. Suzuki and Tsuchihashi classification was used to assess cheiloscopic patterns. The research was conducted for one month, and SPSS version 23.0 was used for analysis.

Results: In both sexes, the predominant palatal rugae patterns were undulating, followed by curved, and then straight. Males had Type V dominant, followed by Type IV, while females had Type I' dominant, followed by Type I.

Conclusion: Cheiloscropy is a more reliable tool than rugoscopy for human identification in the field of forensic science, as shown by our study's conclusion that rugoscopy yielded similar results but cheiloscropy yielded distinct results.

Key-words: Rugoscopy, Cheiloscropy, Forensic Odontology, Palatal Rugae, Lip Prints, School Children

Introduction:

Forensic identification plays a crucial role in criminal investigations, providing valuable evidence for the identification of suspects and victims.[1] Over the years, various techniques have been developed to aid in personal identification, including fingerprinting, DNA profiling, and dental records. Among these emerging techniques, rugoscopy and cheiloscropy have gained attention as novel methods for individual identification. Rugoscopy involves the examination of the rugae patterns on the palate, while cheiloscropy focuses on the analysis of lip prints.[2] These techniques offer advantages such as ease of collection, non-invasiveness, and stability over time.

Rugoscopy involves studying the patterns of rugae, which are irregular ridges located on the anterior part of the palate. The rugae patterns exhibit individual variation and remain relatively stable throughout a person's life. This uniqueness has led to the use of rugoscopy in forensic investigations, particularly in cases where other identification methods may be challenging or unavailable. Cheiloscropy, on the other hand, involves the analysis of lip prints,

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DOI:
<https://doi.org/10.58935/joas.v2i1.26>

Received date: 04/04/2023

Accepted date: 16/05/2023

Published date: 28/05/2023

which are formed by the unique arrangement of grooves, furrows, and lines on the inner surface of the lips.[3] They arise in the 12th–14th week of foetal life and stay stable till the oral mucosa degenerates after death.[4] Lip prints are also known to exhibit individual characteristics, making them valuable in forensic identification.[5]

While extensive research has been conducted on rugoscopy and cheiloscopy in adult populations, limited studies have focused on their application in pediatric populations. The use of these techniques in the identification of child victims or suspects in forensic investigations is particularly important, as traditional identification methods may not be feasible or effective in children. Children, with their ongoing growth and development, present unique challenges in forensic medicine, warranting specialized techniques for their identification.[6]

Central India serves as an ideal setting for this study due to its diverse population and limited research on rugoscopy and cheiloscopy in pediatric populations. Establishing a correlation between rugoscopy and cheiloscopy in Central India's pediatric population would provide valuable insights into the potential application of these techniques in forensic investigations involving children.

Understanding the relationship between rugoscopy and cheiloscopy in the pediatric population can have significant implications for forensic investigations involving children. The results of this study may aid forensic experts and investigators in accurately identifying child victims or suspects, thereby facilitating the delivery of justice in cases involving minors. Moreover, the findings can contribute to the development of standardized protocols and databases specific to the pediatric population, further enhancing the reliability and validity of rugoscopy and cheiloscopy as forensic identification tools.

Aims and Objectives

The purpose was to establish a correlation between various patterns of rugoscopy and cheiloscopy in 5-15 years old school children of central India.

The objectives of this study are

1. To substantiate the relationship between rugoscopic and cheiloscopic patterns in children.
2. To observe any prevalent and specific patterns of rugoscopy and cheiloscopy found in the pediatric population of central India.
3. To determine the effectiveness of cheiloscopic and rugoscopic patterns in assessing a person's identification.
4. To assess and compare among the two, which patterns are the most prevalent in gender statistics.

Materials and Methods

The children of Bhopal city were studied in this study based in schools. Random stratified sampling was used to choose 50 boys and 50 females between the ages of 5 and 15 to take part in the study. The study was done after getting approval from the institution's ethical committee and signed permission from the people who were part of it. Based on how old the people were, they were split into two groups:

Group I: ages 5 to 10

Group II: ages 11 to 15

Patient were chosen based on following:

Inclusion criteria:

Age range between 5 and 15 years.

Domicile (by birth) of central India.

Absence of intraoral active and traumatic lesions.

Absence of any inflammation, pathology and lesions on lips.

Positive informed consent to participate in this study.

Exclusion criteria:

Congenital anomalies/malformations such as cleft palate and cleft lip.

Individuals allergic to alginate, lipstick and cellophane tape.

Individuals undergoing orthodontic treatment.

Individuals with bony and soft tissue protuberances.

Individuals with severe gag reflex.

Individuals previously undergone orthognathic surgery.

Armamentarium:

The materials used for recording palatal rugae is presented in Figure 1



Figure 1: Armamentarium for recording palatal rugae.

The materials used for recording lip prints were:

- Red coloured lipsticks
- Cellophane tape
- White bond paper
- Magnifying glass
- Tissue papers



Figure 2: Armamentarium for recording lip prints.

Methodology:

For obtaining rugoscopic patterns:

After receiving informed consent from each subject, alginate impressions of maxillary arches were made using appropriate perforated metallic trays and study models were poured using Type III Dental stone for interpretation.



Figure 3: Alginate impression being taken

The palatal rugae were delineated using black ineradicable permanent marker. The study models were then analyzed using a magnifying glass and the various parameters were noted in accordance with the Lysell classification (1955) and Thomas and Kotze classification (1983)

Based on the unification, the palatal rugae were classified as:

- Divergent: If two rugae had the same origin from the midline but diverged immediately.
- Converging: Rugae whose origins from the midline are distinct, but whose lateral portions are joined.

The length was recorded in accordance with the Lysell classification and the shape and unification pattern was as per the Thomas and Kotze classification.

For obtaining Cheiloscopy Patterns:

The participants were told to sit up straight. A cotton swab was used to clean their lips in a gentle way. With one smooth stroke, a dark lipstick was put on lips that had been cleaned and dried. The people were asked to rub their lips together to spread the lipstick evenly. After some time, placing the sticky part of the cellophane strip over the lips and lightly pressing at the corners of the lips produced an impression of the lips. The strip was then stuck to a piece of white bond paper. Then, a magnifying glass was used to look closely at the lip prints.

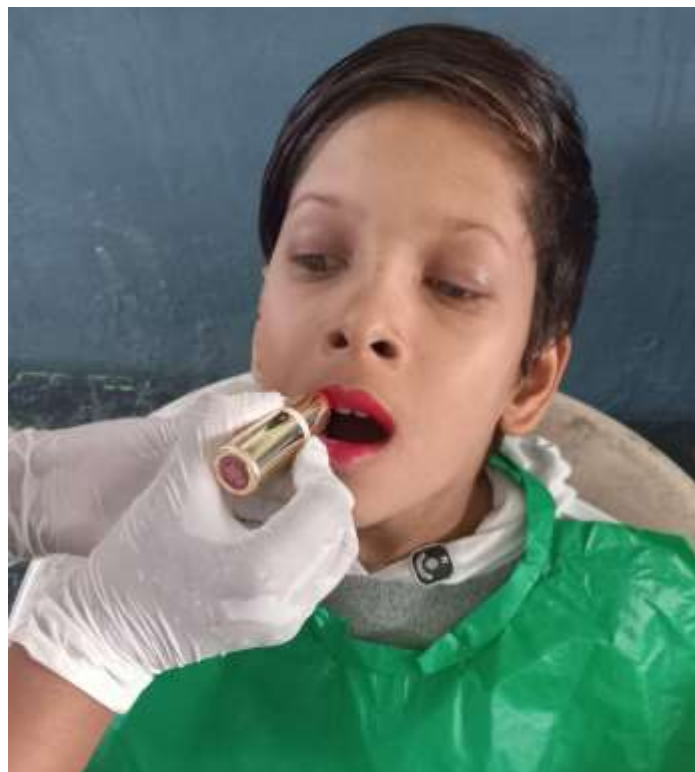


Figure 5: Application of lipstick with lip apart posture



Figure 6: Application of cellophane tape on the lips



Figure 8: Cellophane tape applied on the lips



Figure 9: Removal of cellophane tape from the lips

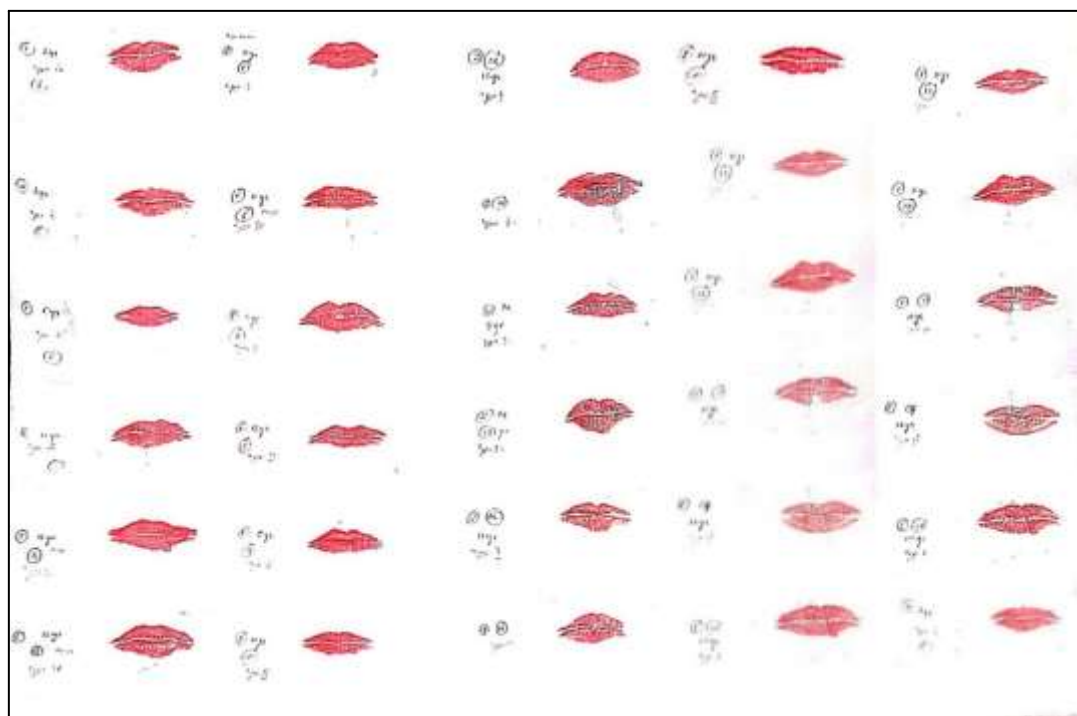


Figure 10: Record of different types of lip prints patterns

For analysis of lip prints, the classification proposed by Suzuki and Tsuchihashi[9] was used.

Type I



Figure 11.1: Type I lip print

Type I'



Figure 11.2: Type I' lip print

Type II



Figure 11.3: Type II lip print

Type III



Figure 11.4: Type III lip print

Type IV



Figure 11.5: Type IV lip print

Type V



Figure 11.6: Type V lip print

Results:

A school based cross-sectional study was done to evaluate and establish a relationship between the rugoscopic and cheiloscopy patterns. A total of 100 subjects (50 males and 50 females) were included in the study and divided into 2 groups which are as follows:

Group I : 5 - 10 years Group II : 11 - 15 years

The results and observations of study were evaluated and interpreted on the basis of following parameters:

Rugoscopy

Examining the patterns of palatal rugae revealed the following findings:

In both boys and girls, predominant shape was undulating, followed by curved, and then straight.

The predominant form observed among the total number of subjects was also undulating. According to the Chi-square test for proportion, there was no significant difference between males and females for various types of palatal rugae patterns. ($P > 0.05$)

Rugoscopic patterns	Males N (%)	Females N (%)	Total N(%)
Curved	20 (51.2)	19 (48.8)	39(39.0)
Wavy	24 (50.0)	24 (50.0)	48 (48.0)
Straight	5 (62.5)	3 (37.5)	8 (8.0)
Circular	1 (10.0)	4 (80.0)	5 (5.0)
Total	50 (50.0)	50 (50.0)	100 (100.0)
Chi square statistic	2.325		
Df	3		
P value	0.507 (NS)		

*= Significant; NS=Not Significant

Table 1: Distribution of rugoscopic patterns among the study population.

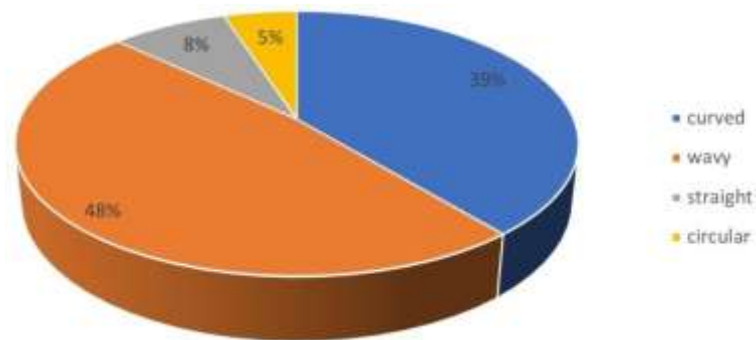


Chart 1: Overall distribution of palatal rugae patterns among the study population

Cheiloscopy

The examination of tongue impressions revealed the following:

Type V, followed by Type IV, was the most common lip print in males, while Type I', followed by Type I, was the most common lip print in females.

Type V was the most common lip print among the total number of subjects, followed by Type I' and Type IV.

The Chi-square test for proportion revealed a significant difference between gender. ($P < 0.05$)

Cheiloscopy Patterns	Males N (%)	Females N (%)	Total N(%)
Type I	2 (11.1)	16 (88.9)	18 (18.0)
Type I'	4 (18.2)	18 (81.8)	22 (22.0)
Type II	2 (33.3)	4 (66.7)	6 (6.0)
Type III	4 (50.0)	4 (50.0)	8 (8.0)
Type IV	16 (80.0)	4 (20.0)	20 (20.0)
Type V	22 (84.6)	4 (20.0)	26 (26.0)
Total	50 (50.0)	50 (50.0)	100 (100.0)
Chi square statistic	40.126		
Df	5		
P value	0.000*		

*= Significant; NS=Not Significant

Table 2: Distribution of cheiloscopy patterns among the study population.

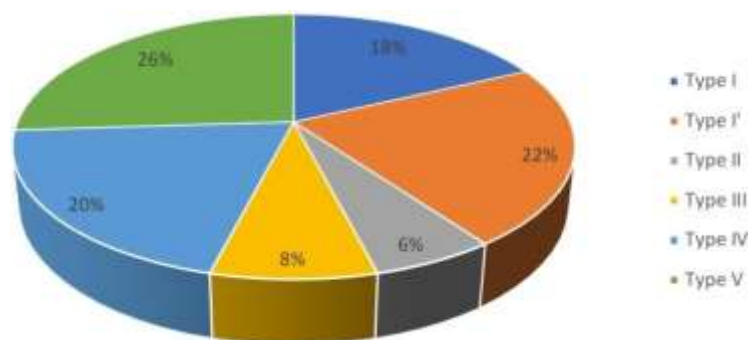


Chart 2: Overall distribution of lip prints among the study population

Discussion

Palatine rugae are asymmetrical and uneven mucosal formations in the anterior third of the palate, generated from the lateral membrane of the incisive papilla in the medial-sagittal plane transverse to the palatine raphe. In 1932, Spanish researcher Troban Hermaso proposed palatal rugoscopy. Many classifications have followed. Most research uses the Lysell, Thomas, and Kotze systems. [11]

Hard connective tissue covering the bone forms palatal rugae in the third month of pregnancy. Rugae's chronology changes with age. Well-trained at birth. Adolescence gives each person their final shape. It changes size but retains shape. Winslow described palatal rugae in 1753. In 1897, Kuppler was the first to research palate anatomy to find racial anatomic traits, according to Caldas et al. Palatal rugae were initially classified by [15] and Lysell. Fisher described lip prints in 1902. De Lille's 1930 investigations led to lip-print applications in criminology. Suzuki and Tsuchihashi classified lip prints into six varieties and dubbed the wrinkles and grooves on lips "sulci labiorum rubrorum" [16]. [17] Lip grooves are irreversible, like fingerprints and palatal rugae. Lip patterns are visible in the sixth week of intrauterine development. [15]

We sought to correlate rugoscopic and cheiloscopy patterns in 100 people—50 males and 50 females. Our investigation found wavy palatal rugae in both males and females, agreeing with Saxena et al. [18] and Sharath et al. [16]. According to Mahabalesh et al. [19], females have more curve-shaped rugae. Our investigation revealed wavy guys, as did Mahabalesh et al.

Our study indicated that females had Type I and Type I' lip prints, while males had Type V and Type IV. Our study's dominant female pattern matched Vahanwala et al.'s [20, 21]. Yogesh et al. found that Type I' and Type IV were more prevalent in females than males [22].

The study's findings may be limited by the size of the sample. Due to logistical constraints and the specific population being studied (pediatric population in Central India), it may be challenging to obtain a large sample size. A small sample size may reduce the generalizability and statistical power of the study. The study is conducted in Central India, which may limit the generalizability of the findings to other geographic regions. The rugae and lip print patterns in the pediatric population of Central India may differ from those in other populations, including different ethnicities or geographical regions. Thus, the results should be interpreted within the context of the specific population under study.

Conclusion

Palatal rugae patterns, lip prints, and fingerprints are human-specific. Rugoscopy and cheiloscopy indicate promise. In females, wavy and curved palatal rugae and Type I and Type I' lip prints were the dominant rugoscopic and cheiloscopic patterns. Wavy and curved oral rugae with Type V and Type IV lip prints dominated male rugoscopic and cheiloscopic patterns. In this study, rugoscopy and cheiloscopy yielded similar and unique outcomes in 5- to 15-year-old boys and girls. Thus, forensic science's cheiloscopy aids human identification more than rugoscopy.

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