The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
20(3): 416-419, 2025 www.thebioscan.com

Correlation Between Palatal Rugae Patterns and Digital Fingerprints in the Bengali Population: A Forensic Study

Dr. Rakshith Shetty[1], Dr. Surajit Bose[2], Dr. Jayanta Chattopadhyay[3], Dr. Subhalakshmi Sen[4], Dr. Maumita Bhattacharya[5], Dr. Pratistha Chhibber[6]

[1] Professor, Department of Oral and Maxillofacial Pathology and Microbiology,

[2,4,5] Associate Professor, Department of Oral and Maxillofacial Pathology and Microbiology, Kusum Devi Sunderlal Dugar Jain Dental College and Hospital, Kolkata, India Kusum Devi Sunderlal Dugar Jain Dental College and Hospital, Kolkata, India.

[3]Professor & Principal, Department of Oral and Maxillofacial Pathology and Microbiology, Kusum Devi Sunderlal Dugar Jain Dental College and Hospital, Kolkata, India

[4] Investigator, UG Student

Kusum Devi Sunderlal Dugar Jain Dental College and Hospital, Kolkata, India

****Corresponding Author:** Dr. Surajit Bose

DOI: 10.63001/tbs.2025.v20.i03.pp416-419

KEYWORDS
Forensic Odontology, Palatal Rugae, Rugoscopy, Fingerprint, Dermatoglyphics, Human Identification, Forensic Science

Received on:

04-06-2025

Accepted on:

02-07-2025

Published on:

08-08-2025

ABSTRACT

Background:

Human identification in forensic science is a critical process employed to establish the identity of individuals in criminal investigations, disaster victim identification, and legal proceedings. This process relies on a variety of scientific methods, including fingerprint analysis, DNA profiling, dental record evaluation, and facial recognition. Among these, fingerprint and DNA analysis are considered highly reliable due to their uniqueness and accuracy. Forensic anthropologists and odontologists also play a significant role by examining skeletal remains to determine age, sex, and ancestry. With advancements in technology, biometric identification and digital forensics have become integral in enhancing accuracy and efficiency.

Aim:

This study aims to evaluate the potential correlation between palatal rugae patterns and digital fingerprint types in individuals from the Bengali population.

Materials and Methods:

A total of 100 subjects (50 males and 50 females), aged 17–25 years, were recruited from Kusum Devi Sunderlal Dugar Jain Dental College and Hospital, Kolkata. Maxillary impressions were made using alginate, and the palatal rugae patterns were traced on dental stone casts. Only individuals without systemic diseases or prior orthodontic/prosthodontic treatment were included. Digital fingerprints were recorded using ink by rolling the thumb from the ulnar to radial side. Ethical clearance was obtained, and informed consent was secured from all participants.

INTRODUCTION

Forensic odontology is a specialized branch of dentistry that involves the examination and analysis of dental evidence in forensic investigations. (David R. and Richard A. #)It plays a vital role in identifying deceased individuals in cases of natural disasters, homicides, and accidents, as well as in the assessment of bite marks and craniofacial trauma. Forensic odontology also contributes to age and sex estimation in medico-legal cases.

One of the lesser-known yet significant aspects of forensic odontology is **rugoscopy**—the study of palatal rugae. Palatal rugae are irregular, asymmetrical mucosal ridges located on the anterior third of the hard palate. (Thorakkal #) These ridges develop during the third month of intrauterine life and remain stable throughout an individual's lifetime. Due to their unique and immutable nature, palatal rugae serve as a reliable means of personal identification, particularly in situations where fingerprints or DNA samples are unavailable. (Catherine et al. #)

Dermatoglyphics, derived from the Greek words "derma" (skin) and "glyph" (carving), is the scientific study of epidermal ridge patterns on fingers, palms, and soles (Anu et al. #). These patterns are formed during fetal development and remain unchanged throughout life. Fingerprints have long been a cornerstone of forensic identification due to their uniqueness, permanence, and ease of collection.

This study integrates two biometric modalities—Rugoscopy and dermatoglyphics—to explore a potential correlation between

palatal rugae and fingerprint patterns, offering an additional tool for forensic identification.

OBJECTIVES

1. To identify and classify different palatal rugae patterns based on shape.
2. To identify and classify digital dermatoglyphic patterns using the Henry Classification System.
3. To evaluate the uniqueness of palatal rugae and fingerprint patterns among the study participants.
4. To assess any potential correlation between palatal rugae and digital fingerprint patterns.

MATERIALS AND METHODS

This cross-sectional study was conducted on 100 subjects (50 males and 50 females) aged between 17 and 25 years, selected from the outpatient department of Kusum Devi Sunderlal Dugar Jain Dental College and Hospital, Kolkata.

Inclusion Criteria:

- Above 16 years of age should be included
- Individuals with no systemic diseases.
- No history of orthodontic or prosthodontic treatment

Exclusion Criteria:

- Any deformities on upper arch
- Not any clear fingerprint should not be included
- Or any disfigurement of the fingers

Procedure:

Fig. 1 Maxillary impressions were made using alginate.

Fig. 2 Casts were prepared using dental stone, and palatal rugae patterns were traced using graphite pencil

Fig. 3 Fingerprints were recorded using an ink-based method. The thumb was rolled from the ulnar to radial side to obtain clear, square, and well-defined prints.

Ethical clearance was obtained from the institutional review board, and informed consent was taken from all participants.

RESULTS

Table 1: Gender and Age Distribution

Variables	N	%
Gender		
Male	42	45.7
Female	50	54.3
Age Group (in years)		
18-20	19	20.65

Table 2: Fingerprint Pattern Distribution

Pattern	N	%
ARCH	3	3.3
LOOP	55	59.8
WHORL	34	36.9
Total	92	100

Observation:

The loop pattern was the most common (59.8%), followed by whorl (36.9%), while the arch pattern was the least common (3.3%).

Table 3: Palatal Rugae Pattern Distribution

Rugae Pattern	N	%
CURVED	37	40.2
STRAIGHT	21	22.8
WAVY	34	37.0
Rugae Pattern	**N**	**%**

Observation:

Curved (40.2%) and wavy (37.0%) patterns were most prevalent, while straight patterns were less common.

Table 4: Association Between Fingerprint and Rugae Patterns

Fingerprint Pattern		Rugae Pattern	Total		
		Curved	Straight	Wavy	

ARCH	N	3	0	0	3
	%	100.0%	0.0%	0.0%	100.0%
LOOP	N	28	12	15	55
	%	50.90%	21.81%	27.27%	100.0%
WHORL	N	6	9	19	34
	%	17.64%	26.47%	55.88%	100.0%
Total	N	37	21	34	92
	%	40.2%	22.8%	37.0%	100.0%
Fisher Exact test		7.31			
p value		0.024*			

Statistical Test: Fisher Exact Test = 7.31
p-value = 0.024 (*statistically significant*)
Interpretation:

- 100% of subjects with arch fingerprints had curved rugae.
- Loop fingerprint types were most commonly associated with curved rugae (50.9%), followed by wavy (27.3%) and straight (21.8%).
- Whorl patterns correlated most frequently with wavy rugae (55.9%).

DISCUSSION

The results indicate a statistically significant correlation between fingerprint types and palatal rugae patterns (p = 0.024). Notably, individuals with arch fingerprints consistently exhibited curved rugae, while those with whorl patterns predominantly had wavy rugae.

These findings suggest a potential genetic or developmental link between the two biometric modalities. Since both fingerprints and palatal rugae patterns develop during early intrauterine life and remain stable throughout an individual's lifetime, their co-occurrence may reflect underlying embryological factors.

The loop pattern was the most common fingerprint type, aligning with global dermatoglyphic trends. Similarly, curved and wavy rugae were most prevalent in the studied population. The observed associations may enhance identification protocols, especially in cases where traditional means of identification are compromised.

CONCLUSION

This study demonstrates a statistically significant correlation between palatal rugae and fingerprint patterns in the Bengali population. The integration of rugoscopy and dermatoglyphics may serve as a complementary method in forensic identification, particularly in mass disasters or when conventional identifiers are unavailable. Further research with larger, diverse samples is recommended to validate these findings and explore underlying genetic associations.

REFERENCES

- Sharma A, et al. "Dermatoglyphics: A review on fingerprints and their changing trends of use." *CHRISMED J Health Res*, vol. 5, no. 3, 2018, p. 167.
- Catherine, Adams, et al., editors. *Forensic Odontology: An Essential Guide*. Wiley, 2014-01-17.
- David R., Senn, and Weems Richard A., editors. *Manual of forensic odontology*. Fifth edition ed., Boca Raton, Fla, CRC Press, 2013. Senn, David R., and Richard A. Weems, editors. Manual of Forensic Odontology. Fifth edition, CRC Press, 2013.
- Thorakkal, Shamim. "The reliability of palatal rugoscopy in forensic identification." *Annals of Saudi Medicine*, vol. 33, no. 5, 09/2013, pp. 513-514.