



STUDY OF PALATAL RUGAE AMONG THE STUDENT POPULATION FROM NORTH - EASTERN AND WESTERN INDIA

Dr. Sheen Singh Mehta^a, Dr.Tondon Devi Athokpam^b, Dr. Swathi Sharma^c Dr Monica Athokpam^d, Dr Sanjiv Nandeibam^e.

Abstract

Proposed by Torbo Hermosa in 1932, Palatoscopy is the study of palatal rugae pattern. Rugae patterns are stable and unique to every individual just as his/her finger prints and DNA comparisons. Once formed, they stay robust for the rest of our lives and are resistant to burns, chemicals and decomposition. For challenging forensic identification, as needed in mass disasters, major fire outbreaks and decomposition of bodies where finger print data, DNA matching cannot be made available, rugoscopy can be used as an alternative for human identification especially in situations that lead to teeth loss or involve edentulous persons.

Objectives

The purpose of this study is to determine the most prominent rugae patterns in terms of shape, number and orientation and delineate the differences in rugae patterns among individuals

from eastern and the western regions of India. Rugae patterns being specific to ethnic groups can be used effectively in population identification.

Methods

The rugae patterns were assessed by applying Thomas and Kotze classification and Carrea classification for 50 individuals of the same age group. 25 males and females from North Eastern India and 25 males and females from western India respectively.

Association between the Rugae patterns were assessed using independent t test and chi square tests.

Results. There was a significant difference present in the number of Rugae in the north eastern and western populations with $p > 0.05$. The predominant shape was Wavy.

Conclusion. Rugae pattern may be an adjunctive method of differentiating between the North-eastern and western populations. A larger sample study might be undertaken to validate this claim.

Keywords: Palatal rugae, human identification, rugoscopy, rugae patterns.

a-Assistant professor, Department of Prosthodontics, DY Patil, Pune

b- Private Practitioner, Imphal, Manipur.

c- Private Practitioner, Sirohi, Rajasthan

d-Private Practitioner, Imphal, Manipur, **e-** Private Practitioner, Imphal, Manipur.

INTRODUCTION

Identification of a dead individual is a pre-requisite for certification of death for personal and legal reasons. Post mortem identification of an individual is possible by visual examination, finger printing and DNA profiling. In cases where such records are missing like in mass disasters, bioterrorism, decomposed or charred bodies, forensic odontology plays a pivotal role. Dental identification relies mostly on comparison between antemortem and postmortem records of the patient and becomes vitally important because of the lack of extensive database for fingerprints.¹

Forensic odontology involves the bite mark analysis, analysis of human remains by mostly collecting data from oral and maxillofacial regions including teeth, chronological estimation of dental age, sex or gender identification using teeth and jaw anatomy, race identification, use of lip prints or wrinkles or grooves on the lip called cheiloscopy. In conditions where such data cannot be made available palatal rugae can be used as one of the alternatives.

Palatoscopy and Rugoscopy

Palatoscopy/ rugoscopy refers to study of palatal rugae pattern in order to establish a person's individual identity.² Palatal Rugae develop around 3 months of intrauterine life from the calcified mesenchymal tissue. The exact configuration and orientation take place by 12- 14 weeks of prenatal life and stays robust even after the demise of an individual.³

The uniqueness of palatal rugae can provide reliable sources of identification. The human palatal rugae are protected by trauma due to their internal position in the head and are insulated from heat by teeth, tongue and buccal pad of fat. Furthermore, palatal rugae are resistant to chemical aggression, thermal effects and decomposition changes.⁴ No two individual's palatal rugae are identical and remain same throughout the life, reappear after surgery or trauma and if destroyed reappear in the exact same position⁵

The present study is an attempt to determine the number and different patterns of rugae in eastern and western Indian populations to identify the predominant pattern and number of rugae in the two ethnic groups in order to effectively identify the populations.

MATERIALS AND METHODS

The present study was conducted in the Department of Prosthodontics at DY Patil Dental college and Hospital Pune. A total of 50 subjects, 25 males and females from North Eastern states mainly Manipur and Assam and 25 males and females from western regions mainly Rajasthan were selected. The study was conducted after obtaining institutional ethical committee clearance and informed written consent from subjects.

INCLUSION CRITERIA

Volunteers and healthy individuals between 20-25 years of age, having North-Eastern and Western Indian origin, subjects without braces, without removable or fixed partial dentures and with no history of orthodontic maxillary expansions were selected.

EXCLUSION CRITERIA

Subjects with braces, Removable or fixed partial dentures, patients older than 25 years, abnormalities and inflammations of palate or lips and congenital defects like the cleft palate and cleft lip. Individuals belonging to regions other than north eastern and western parts of India, palatine torus, diastema.

METHODOLOGY

Patients were made to sit comfortably; complete examination was done. Backrest was raised to an angle of 45° for maxillary impression and chair raised to level of elbow of the operator. Maxillary perforated impression trays were selected according to the size of the patients' arches. Alginate impression material (Dentsply, Zelgan) and water were mixed according to the manufacturer's instruction using a plastic bowl and stiff plastic alginate mixing spatula. (W:P-40ml: 15g.). A smooth and creamy mix was loaded into the tray. The surface of the alginate in the tray may be smoothed out using a moist finger. Before inserting the tray, the palatal rugae area was wiped off with dry cotton to give smooth impression details. Small amount of mixed material was applied on the palatal rugae area with the index finger. This helps to reduce air voids and

improve accuracy. The loaded tray was immediately inserted into the patient’s mouth. The tray was held passively and firmly during the setting of the material. After about two minutes, the seal was freed by running the finger around the periphery and separated quickly from the teeth to avoid rocking and possible deformation of the fine area of the impression. Excess material at the periphery was trimmed smoothly with BP blade.

PREPARATION OF THE STUDY CASTS

High strength type 3 Gypsum (orthostone) was mixed according to the manufacturer's W: P ratio and poured on the alginate impression tray, kept on the vibrator. It was added in small increments. The cast was separated from the impression after 60 minutes. Base former were used to pour the base. Each cast was numbered and labelled for easy identification.

MEASUREMENTS

All measurements were taken by a single observer to avoid the bias. The observations were made in a quite well illuminated room. The study casts were placed on a horizontal base. The rugae were highlighted by a sharp graphite pencil or a black marker. Magnification lens was used for identification.

Measurement was done using a plastic ruler (kenson) in millimetres.

The method of rugae identification was based on the classification given by the **Thomas and Kotze 1983 and Carrea 1955.**

LENGTH	PRIMARY	> 5mm
	SECONDARY	3 > <5 mm
	TERTIARY	< 3 mm
SHAPE	STRAIGHT	Run directly from origin to termination

	CURVED	Simple crescent shape that is curved gently. Curved rugae have a bend at origin or termination.
	WAVY	Curved rugae have a bend at origin or termination.
	CIRCULAR	Display a continuous ring formation
	DIVERGING	Same origin, split laterally
	CONVERGING	Begin at more than one origin but unite at their lateral positions.

Table 1a: Thomas and Kotze (1983) classification of palatal rugae

	TYPE I	Posterior anterior directed rugae.
	TYPE II	Rugae perpendicular to the palate.

ORIENTATION	TYPE III	Anterio posterior directed rugae.
	TYPE IV	Rugae directed in several directions.

Table 1b: Carrea classification (1955) of rugae direction

COMPARISON IN TOTAL NUMBER RUGAE IN BETWEEN THE EASTERN AND THE WESTERN POPULATION

Total number of 300 palatal rugae were observed in 50 subjects. Average number of rugae found in each individual were 9 of which 4-5 rugae were present on each side of the palate. Most common pattern being the wavy rugae. In eastern population of 25 individuals a total of 162 number of rugae were analysed with a mean value- 3.8 ± 1.3 while in 25 individuals of western population a total number of 138 rugae were analysed with a mean value of 3.8 ± 2.14 for the most common wavy Rugae pattern **table 2, Graph 1.**

Attribute	F	t	df	p-value	Mean Difference
Wavy	0.333	0.000	38	1.000	0.000
Curve	3.996	1.385	38	0.174	0.650
Straight	0.149	-0.512	38	0.612	-0.200
Divergence	7.790	1.726	38	0.093	0.500
Convergence	2.408	0.737	38	0.466	0.100

Table 2: Mean number of palatal rugae based on rugae pattern according to Thomas and Kotze in Eastern and Western population

Statistically significant - difference were observed in the number of rugae between the

eastern and the western population with p value being ≥ 0.05 .

COMPARISON OF THE SHAPE BETWEEN POPULATION IN THE EASTERN AND WESTERN POPULATION

Common shape of Rugae seen in both the groups was wavy. While western group had wavy and straight shape (58 % and 22%, respectively) Eastern group had mostly Wavy and curved patterns (54% and 29% respectively) Eastern population had 84% divergent Rugae, western had 84.6% divergent pattern. Convergent pattern was 16% in eastern and 15.4% in western. Table3

GRAPH 1

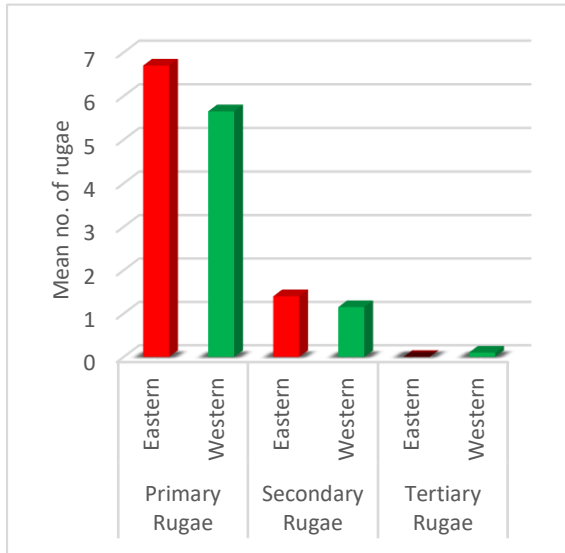
Attribute	Groups	Number of rugae	Percentage
Wavy	Eastern	76	54%
	Western	76	58%
Curve	Eastern	41	29%
	Western	28	22%
Straight	Eastern	24	17%
	Western	28	22%
Divergence	Eastern	21	84%
	Western	11	84.6%
Convergence	Eastern	4	16%
	Western	2	15.4%

Table-3 Comparison of shape between two ethnic groups.

GRAPH -2

COMPARISON IN SIZE RUGAE (LENGTH) IN EASTERN AND WESTERN POPULATION

Both the population's had more primary rugae i.e., more than 5mm. p value for the primary rugae was 0.048 i.e., <0.05 and hence was statistically



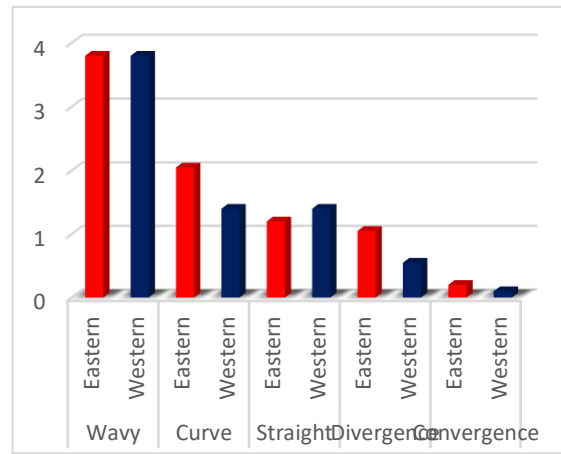
significant in the independent t test, rejecting the null hypothesis.

COMPARISON IN DIRECTION BETWEEN EASTERN AND WESTERN POPULATION.

Eastern population indicated predominantly type IV or rugae directed in several directions. The western group however had majority in type I or posterior anteriorly or backwards directed rugae. Chi square test was performed and p value was 0.082. Table 4

Group	CARREA Classification				X ²	p-value
	I	II	III	IV		
Eastern	6	3	5	6	6.69	0.082
	30%	15%	25%	30%		
Western	9	6	0	5	6.69	0.082
	45%	30%	0.0%	25%		

Table-4 Chi square test for orientation of rugae.



DISCUSSION

Rugae pattern of people belonging to different ethnicity differ within a country. Studies done by Khan et al⁶, Asdillah et al⁷, Saini et al⁸, all mentioned about differences in the palatal rugae pattern of different Indian population. This study found that the primary rugae were the most dominant pattern of Rugae in both the western and eastern groups. They were more on the right side than on the left side in both the groups. This was in agreement with study by Annu Saini and Achint Garg⁸ 2013, which stated that the number of Rugae present in the right side is higher than left for the North eastern population. This data did not agree to the study done by Bajracharya et al⁹ March 2014 which stated that primary rugae were more prominent in the left than right side and study by Kallianpur¹⁰ et al that reported left side rugae to be dominant and owed it to the phenomenon of regressive evolution.

Primary rugae in our study were more in the eastern ethnic group as compared to the western group. Kashima et al¹¹ 1990 compared the palatine Rugae and stated that Japanese children had more primary rugae than Indian children. Kapali et al¹² 1997 found more primary rugae in Australian aborigines than the Caucasoids.

Our study found the wavy pattern to be the dominant pattern of rugae in both the groups, these findings agree with Abdellatif et al¹³ 2011, who found wavy pattern to be most common in Egyptian population and studies that found wavy Rugae as the predominant shape in Indian

population by Atnal A, Kiran AR¹⁴;2014. however, this is in contrast to the study by Eboh¹⁵ 2012 who found straight shape to be more common. Divergent pattern of Rugae was found to be dominant in both the ethnic groups with the difference being statistically insignificant. This was in agreement with the study by Shetty et al¹⁶ 2011 which concluded that both converging and diverging Rugae did not show any specific trend in young adult Indian population belonging to Mangalore and study by Vivanthan Prabhu Rajan¹⁷ 2013 done on Indian children in the age group 5-15 years. According to the direction or orientation as given In Carrea classification Type I and Type IV occurs with equal frequencies in eastern population. With the type I or backwardly directed Rugae being the prominent pattern in both the groups. A study by Manjunath et al¹⁹(2012) found that wavy perpendicular and backwardly directed Rugae were more in Indian male populations.

Conclusion:

Within the limits of this study, we could conclude that a specific Rugae pattern was found in terms of shape, number and orientation amongst the two ethnic groups. More longitudinal studies on wider population groups need to be done. The smaller sample size could be a limiting factor in our short study.

Conflicts of interest

The Authors have stated no conflicts of interest among themselves.

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