ORIGINAL ARTICLE

Correlation and Examination of the Predominant Palatal Arch form within the Male and Female between North Indian and Negroid Population

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ABSTRACT

Background: Palatal rugoscopy is the examination of the palatal rugae. The majority of people concur that a person's rugae pattern remains constant throughout their lives. The rugae pattern can endure injury or burns better than most other anatomical structures because of their interior placement in the head. Because rugae patterns are believed to be unique, much like fingerprints, they are also utilised for personal identification. Examining and correlating the dominant palatal arch form with the male and female groups in North Indian and Negroid populations was the aim of this study. The sample consists of 80 plaster casts, ages 18 to 25, split equally across two groups and genders.

Method: After taking an impression of the maxillary arch, a plaster cast was made using alginate impression material. The rugae were recognised on the cast and described in accordance with Thomas and Kotze (1983) and Kapali *et al*. (1983) using a sharp graphite pencil and adequate illumination and magnification

Result: Class B (V-shaped palate) was the most common palatal arch form (16/40; 40.00%) in Negroid subjects, followed by Class C shape. In Indian subjects, Class C (U-shaped palate) was the most common palatal arch form (19/40; 47.50%), followed by Class A and Class B shapes.

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Conclusion: The rugae pattern is another method of distinguishing between North Indian and Negroid, based on the limitations of the current study.

INTRODUCTION

The term "rugae" in anatomy describes a group of ridges formed when an organ's wall folds. The layer of mucus that covers the hard palate's anterior section in the oral cavity exhibits irregular raised ridges. They emanate from the front portion of the palatine raphe on either side or the incisive papilla in a slightly transverse manner.[1] A fatty antero-lateral zone is formed as a result of the submucosal cushion of adipose tissue supporting them laterally. Underlying the stratified squamous type lining epithelium lies a rich collagenous connective tissue.[2] The term "Palatal Rugoscopy" or "Palatoscopy" refers to the study of palatine rugae, and it was originally used in 1932 by Spanish researcher Trobo Hermosa[3] Rugae patterns are known to be persistent and distinctive oral topographical features that are specific to each individual, much like their finger prints[4] Rugae patterns are known to be persistent and distinctive oral topographical features that are specific to each individual, much like their finger prints and between the period of development and the degeneration of the mouth mucosa upon death, this distinctive pattern does not change. Rugae are observed to remain constant in both quantity and quality all entire life; nevertheless, Several writers have noted variations in the average number of rugaeageing[5] Rugae patterns are known to be persistent and distinctive oral topographical features that are specific to each individual, much like their finger prints. The tongue, cheek, lip, teeth, and alveolar process encircle the rugae, which are positioned in a more secure area within the oral cavity. As a result, They have good defences against injury, excessive sucking finger during early life, and ongoing strain from dentures and orthodontics therapy. Due to its distinctiveness, stability, and resilience to harm, the palatal rugae are a valuable anatomical landmark in forensic investigations.[6] In a similar vein, differences in racial, ethnic, and regional patterns also affect how people are identified, particularly in the context of mass disasters and forensic anthropology.[7-9] There are typically three to six rugae beside the median palatine raphe on either side; however, the quantity may vary from side to side. A ruga's length is often measured transversely, from the mid-palatine raphe, where it starts, to its terminus[10] Every ruga's orientation pattern is ascertained with reference to the mid-palatal raphe (MPR). The pattern of direction of a given ruga is resolute by the angle formed by the line connecting its origin and termination. Positive angles are linked to forward-directed rugae (F), while backward-directed rugae (B) have negative angles. Ruga that runs parallel to MPR is regarded as perpendicular (P) and is deemed a horizontal (H) if the angle is zero[11] (*Figure 1*)
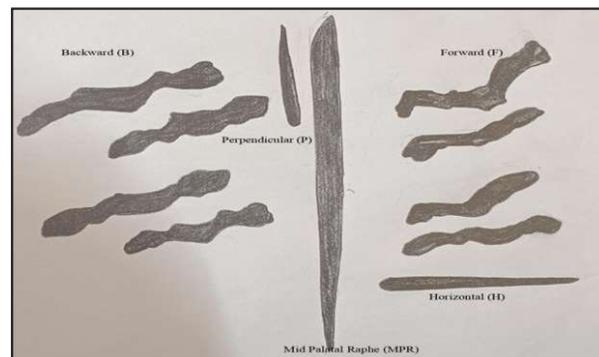
Figure 1: The palatal rugae's orientation patterns with respect to the midpalataine raphe

MATERIAL AND METHODS

The purpose of this study was to analyse a sample that is typical between North Indians and Negroids population. The study was carried out with approval from the medical research ethics council of Sharda University, Greater Noida's Faculty of Medicine. Each of these unique having healthy subjects, no braces and partial denture (removal as well as fixed) were employed for this study. Participants under the age of eighteen who had undergone orthodontic treatment in the past or who had any trauma, deformity, or scar were not allowed to participate in

this study. There are forty subjects in every group. Forty North Indian students from Sharda University make up Group I. Group II contained forty Nigerian pupils. In both groups, the distribution of sex and race was equal. The participants were informed about the research after signed consent informed by the subjects was obtained, and the technique was explained to them along with any unexpected risks that could occur throughout the ethical committee. Every person was given a code in order to safeguard the confidentiality of the information. This coding or labelling technique was designed to safeguard the data in order to enable a fair statistical analysis to be carried out. Palatal impressions were taken, as mentioned by[12] every individual was between the ages of 18 and 25. In a sterile rubber bowel, a precise quantity of fast-setting flavouring alginate powder was combined with regular water. Using a stainless-steel spatula and swirling for 30 seconds, the air bubbles were eliminated by shaking. The alginate paste was poured into a suitably sized partly perforated maxilla impression tray. After that, the tray was pressed firmly on the volunteer's palate for ninety seconds while they were holding it in their mouth. During this period, the participants were told to keep their mouths open. Once the imprint had solidified into a semisolid condition, it was gently removed and rinsed under running water to remove any remaining saliva or debris. The impression was then promptly mixed with stone powder to produce the most accurate dental cast imaginable. After the casts had solidified, they were examined carefully and to improve their visualization, the rugae were marked out using an HB pencil with a 0.1 μ tip (*Figure 2*). We counted the rugae and identified the mid-palatal raphe to its left and right. From anterior to posterior, a number (such as 1, 2, 3,... 6) was assigned to every ruga to MPR's left and right (*Figure 3*) As a result, three different palatal variants were distinguished.

Class A: Palate flat, shallow, and wide

Class B: somewhat vaulted palate with a V shape

Class C: U-shaped palate and high vaulted ceiling

A certified statistician used IBM Corp.'s SPSS Version 21.0 (Armonk, NY) to perform statistical analysis on the collected data. The mean values of two samples were compared using the Student's t-test, and the significant difference between the two sets of data was examined using the Chi-square test.

Figure 2: Material Used
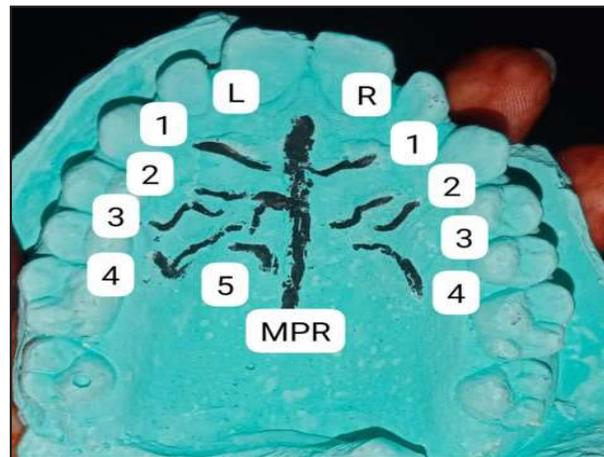
Figure 3: The mid-palatineraphaerugae patterns and their corresponding numbers

RESULT

Following a comprehensive examination of eighty research models, the following findings were made.

Table 1 compares the predominant palatal arch form among two population groups. Among Indian subjects, Class C (U-shaped palate) was the predominant palatal arch form (19/40; 47.50%) followed by Class A and Class B shapes; whereas, in Negroid subjects, Class B (V-shaped palate) was the predominant palatal arch form (16/40; 40.00%) followed by Class C shape. There was a significant difference in the predominant palatal arch form among two population groups.

Table 1: Comparison of the predominant palatal arch form among two population groups

Shape	Indian		Negroid		p-value
	n	%	n	%	
Class A (Flat Palate)	12	30.00	11	27.50	
Class B (V - Shaped Palate)	20	50.00	6	15.00	0.001*
Class C (U - Shaped Palate)	8	20.00	23	57.50	
Total	40	100.00	40	100.00	

Chi-square test; * indicates a significant difference at p≤0.05

Table 2 the predominant palatal arch form between Indian male and Indian female subjects. Among Indian female and male subjects, Class B was the predominant palatal arch form (9/20; 45% & 11/20; 55% respectively). There was a non-significant difference in the predominant palatal arch form between Indian male and Indian female subjects.

Table 2: Comparison of the predominant palatal arch form between Indian male and Indian female subjects

Shape	Female		Male		p-value
	n	%	n	%	
Class A (Flat Palate)	6	30.00	6	30.00	
Class B (V - Shaped Palate)	9	45.00	11	55.00	0.705 (NS)
Class C (U - Shaped Palate)	5	25.00	3	15.00	
Total	20	100.00	20	100.00	

Chi-square test; NS: Non-significant difference

Table 3 compares the predominant palatal arch form between Negroid male and Negroid female subjects. Among Indian female and male subjects, Class B was the predominant palatal arch form (11/20; 55% & 12/20; 60% respectively). There was a non-significant difference in the predominant palatal arch form between Negroid male and Negroid female subjects.

Table 3: Comparison of the predominant palatal arch form between Negroid male and Negroid female subjects

Shape	Female		Male		p-value
	n	%	n	%	
Class A (Flat Palate)	8	40.00	3	15.00	
Class B (V - Shaped Palate)	1	10.00	5	25.00	0.083 (NS)
Class C (U - Shaped Palate)	11	55.00	12	60.00	
Total	20	100.00	20	100.00	

Chi-square test; NS: Non-significant difference

Table 4 compares the predominant palatal arch form between Indian male and Negroid male subjects. Among Indian male subjects, Class B was the predominant palatal arch form (11/20; 55%); whereas, in Negroid male subjects, Class C was the predominant palatal arch form (12/20; 60%). This difference in the predominant palatal arch form between Indian male and Negroid male subjects was significant.

Table 4: Comparison of the predominant palatal arch form between Indian male and Negroid male subjects

Shape	Indian		Negroid		p-value
	n	%	n	%	
Class A (Flat Palate)	6	30.00	3	15.00	
Class B (V - Shaped Palate)	11	55.00	5	25.00	0.013*
Class C (U - Shaped Palate)	3	15.00	12	60.00	
Total	20	100.00	20	100.00	

Chi-square test; * indicates a significant difference at p≤0.05

Table 5 compares the predominant palatal arch form between Indian female and Negroid female subjects. Among Indian female subjects, Class B was the predominant palatal arch form (9/20; 45%); whereas, in Negroid female subjects Class C was the predominant palatal arch form (11/20; 55%) each. This difference in the predominant palatal arch form between Indian female and Negroid female subjects was significant.

Table 5: Comparison of the predominant palatal arch form between Indian female and Negroid female subjects

Shape	Indian		Negroid		p-value
	n	%	n	%	
Class A (Flat Palate)	6	30.00	8	40.00	
Class B (V - Shaped Palate)	9	45.00	1	10.00	0.011*
Class C (U - Shaped Palate)	5	25.00	11	55.00	
Total	20	100.00	20	100.00	

Chi-square test; * indicates a significant difference at p≤0.05

DISCUSSION

Palatal rugae patterns are mostly employed in forensics to ascertain an individual's identity and ethnic origin. Rugoscopy is still a relatively young technique in the field of forensic odontology. Despite the fact that

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Winslow described palatal rugae in 1753,[13-15] as well as Harrison Allen[13,15] suggested in 1889 utilising them for personal identification, It was not until 1955 that Lysell[13,14] offered a precise taxonomy of palatal rugae. Later investigators like Peavy and Kcndrick (1967). Thomas (1972), Comoy (1973), Bamberadeniya (1978), and van der Linden (1978) classified palatal rugae[13-16] Lysell's (1955) classification was updated by Thomas CJ and KotzeTJvW in 1983, and it is currently recognised as the most extensively used one. It is regarded as the most widely accepted categorization, having been altered by Thomas CJ and KotzeTJvW in 1983[14] Palatal rugae have been studied in forensic odontology for many purposes, the main one being personal identification. Many researchers, notably Carrea (1938), Lysell (1955), Sassouni (1957), and English *et al.* (1988), have shown that palate rugae are unique[13,14,16,17] Furthermore, it has been shown that rugae maintain the same shape during their entire lives[18] Its structure and design remain unaltered and are not affected by heat, chemicals, illness, or stress. In the event that Palatal rugae disappear, they are precisely replicated in the same location where they originally existed[19-21] In our study raveled that Class B (V-shaped palate) was the most common palatal arch form in Negroid subjects, followed by Class C shape. In Indian subjects, Class C (U-shaped palate) was the most common palatal arch form followed by Class A and Class B shapes. A qualitative analysis of rugae pattern in gujarati population by Jayashankar PIllai *et.al*[22] revealed that The most common type of palate was class B, which was followed by classes A and C. We firmly believe that the palatal rugae pattern is utilised within forensic research as a backup technique for determining gender in light of these findings. However, further research with a bigger sample size is required to validate these results. Furthermore, analysing the rugae patterns in additional Indian population samples could support our findings even further.

CONCLUSION

Anatomical structures known as palatal rugae have implications for medicine, anthropology, and forensics. But there isn't a uniform procedure for preserving data records and evaluating rugby. Because the rugae are classed based on length, this classification

is fortunate. To verify the function of palatal rugae in forensic identification, more research with a bigger sample size is necessary. More investigation verify the function of palatal rugae in forensic identification, a larger sample size is needed.

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