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Symmetry and Asymmetry in the Rugae Pattern on the Left and Right Sides of the Mid-palatal Raphe (MPR) in North Indian and Nigerian Population

Ishika Bhardwaj[1], Sally Lukose[2], M. Siddharth[3]

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ABSTRACT

Most people agree that a person's palatal rugae pattern doesn't change throughout the course of their lifetime, and this is known as palatal rugoscopy. The rugae pattern can survive when most other anatomical components are burned or destroyed because of their interior placement in the cranium. Because rugae patterns are believed to be as distinctive as fingerprints, they are also utilised for personal recognition. This study's objective was to distinguish and contrast the palatal rugae of North Indians and Negroids in terms of quantity, size, and morphology. There are two categories in the study: North Indians and Negroids. The sample consists of 40 plaster casts, evenly split between two groups and genders, with ages ranging from 18 to 25. Method To identify the rugae on the cast and classify them according to Kapali *et al*. (1983) and Thomas and Kotze (1983), a sharp graphite pencil, adequate illumination, and magnification were required. Result The overall count of rugae in the Nigerian and North Indian communities to the right and left of MPR ranged from three to twelve, according to the quantitative study. North Indian males and females had a maximum of 10 rugae, while Nigerian males and females had a maximum of 12 rugae. In North Indian males and females, the lowest rugae count was 10, and it was found in three. In Nigerian male and female the least count of rugae was 5 and it was present in 2. Conclusion Given the limits of the current study, another way to differentiate between North Indian and Negroid is through the rugae pattern.

KEYWORDS

• Orthodontics • Palatoscopy • Forensic dentistry • Rugae patterns • Forensic identification • Palatal rugae palatal arch shape

AUTHOR'S AFFILIATION:

[1] Assistant Professor, Department of Forensic Science, Sharda University, Greater Noida, Uttar Pradesh, India.

[2] Professor, Department of Forensic Science, Sharda University, Greater Noida, Uttar Pradesh, India.

[3] Dean of School of Dental Sciences, Sharda University, knowledge Park III, Greater Noida, Uttar Pradesh, India.

CORRESPONDING AUTHOR:

Sally Lukose, Professor, Department of Forensic Science, Sharda University, Greater Noida, Uttar Pradesh, India.
E-mail: sally.lukose@sharda.ac.in

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INTRODUCTION

In anatomy, "rugae" refers to a collection of ridges created when the organ's wall folds. The layer of mucus that covers the anterior portion of the hard palate in the oral cavity has irregular raised ridges. They extend somewhat transversely from the incisive papilla or the anterior part of the palatine raphe on either side.[1] The submucosal cushion of adipose tissue supports them laterally, resulting in the formation of a fatty antero-lateral zone. The lining epithelium of the stratified squamous type has a rich collagenous connective tissue underneath[2] Spanish scholar Trobo Hermosa coined the term "Palatal Rugoscopy" or "Palatoscopy" in 1932 to describe the study of palatine rugae[3] Similar to finger prints, rugae patterns are recognised as enduring and unique oral topographical characteristics that are unique to each person[4] Similar to a person's fingerprints, rugae patterns are recognised as enduring and unique oral topographical characteristics that are unique to each individual. These patterns remain constant throughout the growth stage and the deterioration of the oral mucosa after death. Although the quantity and quality of rugae are shown to be stable throughout life, several authors have observed changes in the average number of rugae as they age[5] Similar to finger prints, rugae patterns are recognised as unique and enduring oral topographical characteristics that are unique to each person. The tongue, cheek, lip, teeth, and alveolar process encircle the rugae, which are situated in a more secure area of the oral cavity. As a result, they are shielded from injury, excessive finger sucking during infancy, and ongoing stress from orthodontic treatment and dentures. The palatal rugae are a useful anatomical landmark in forensic investigations because of their uniqueness, durability, and resistance to damage[6] Similarly, variations in racial, ethnic, and geographical patterns also influence how individuals are recognised, especially when it comes to forensic anthropology and mass tragedies[7,8,9] On either side of the median palatine raphe, there are usually three to six rugae, however the number might differ from side to side. The length of a ruga is frequently measured transversely, from its beginning at the mid-palatine raphe to its end.[10]

MATERIAL AND METHOD

The purpose of this study was to analyse a sample that was representative of the North Indian and Negroid populations. The study was approved by the medical research ethics council of Sharda University's Faculty of Medicine in Greater Noida. For this study, both removable and fixed partial dentures were used, and each of these included healthy patients without braces. This study excluded participants under the age of eighteen who had previously received orthodontic treatment or who had any scars, deformities, or trauma. Each group consists of 72 participants. Group I consists of forty Sharda University students who are North Indian. There were seventy two Nigerian students in Group II. Race and sex were equally distributed in both groups. After the individuals' signed agreement was received, the research was explained to the participants, who were also briefed on the procedure and any unforeseen dangers that might arise within the ethics committee. To ensure the secrecy of the information, each individual was assigned a code. The purpose of this labelling or coding technique was to safeguard the data in order to conduct an equitable statistical analysis. According to[11], all of the people who had their palatal impressions taken were between the ages of 18 and 25. A specific amount of fast-setting flavoring alginate powder was mixed with ordinary water in a sterile rubber bowel. The air bubbles were removed by shaking after 30 seconds of whirling with a stainless-steel spatula.

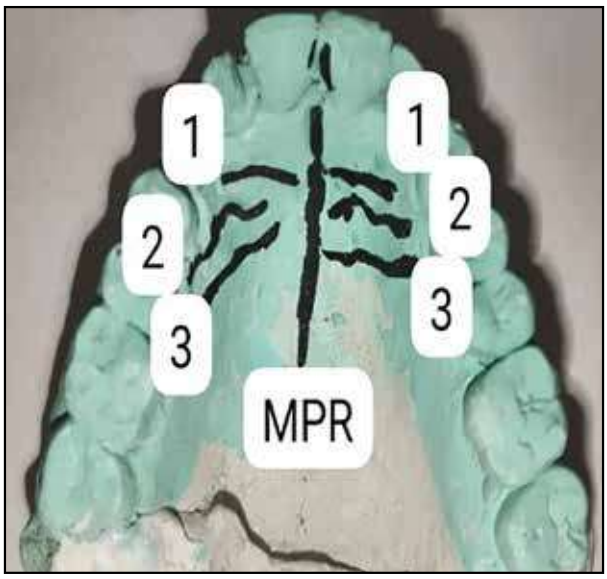

Figure 1: Showing Symmetry in Rugae Pattern

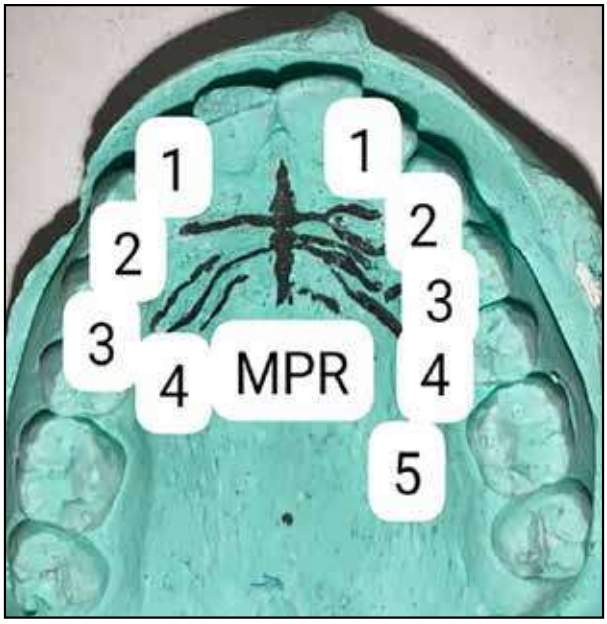

Figure 2: Showing Asymmetry in Rugae Pattern

A maxilla impression tray that was appropriately sized and somewhat perforated was filled with the alginate paste. The participant then held the tray in their mouth for 90 seconds while it was firmly placed against their palate. For identification, count the number of rugae. If the numbers of rugae are same then it is symmetry (Fig. 1) otherwise it is asymmetry (Fig. 2).

RESULT

The total count of rugae in the North Indian male and female right and left of MPR ranged from three to ten, according to the quantitative analysis. 8.33% of males and 11.42% of females had a maximum of 10 rugae. Three (8.33%) of the male samples had rugae, which was the lowest number among males (10). The lowest rugae count in females was 3, and it was found in 3 (8.57%).(Table 1)

Table 1: The rugae count distribution of North Indian male and female samples, from lowest to maximal

Gender	Total rugae present in the each palate (minimum 3 and maximum 10)								Sample Size
	3	4	5	6	7	8	9	10	
Male Count	4	5	4	5	4	6	5	3	36
Percentage within gender	11.11	13.88	11.11	13.88	11.11	16.66	13.88	8.33	100
Female Count	3	4	0	7	6	5	6	4	35
Percentage within gender	8.57	11.42	0	20	17.14	14.28	17.14	11.42	100
Total Count	7	9	4	12	10	11	11	7	71
Percentage within gender	9.8	12.6	5.6	16.90	14.08	15.49	15.49	9.8	100

The total count of rugae in the Nigerian male and female right and left of MPR ranged from 5 to 12 rugae, according to the quantitative study. 13.88% of males and 17.14% of females had a maximum of 12 rugae. Two (5.55%) of the male samples had rugae, which was the lowest number in males at six. The lowest rugae count in females was 5, and it was found in 2 (5.71%).(Table 2)

Table 2: The rugae count distribution of Nigerian male and female samples, from lowest to maximal

Gender	Total number of rugae in each palate (minimum five, maximum twelve)								Sample Size
	5	6	7	8	9	10	11	12	
Male Count	3	2	3	4	7	4	8	5	36
Percentage within gender	8.33	5.55	8.33	11.11	19.44	11.11	22.22	13.88	100
Female Count	2	5	3	3	6	4	6	6	35
Percentage within gender	5.71	14.28	8.57	8.57	17.14	11.42	17.14	17.14	100
Total Count	5	7	6	7	13	8	14	11	71
Percentage within gender	7.04	9.85	8.45	9.85	18.30	11.26	19.71	15.49	100

The total count of rugae in the Nigerian and North Indian females on the right and left sides of MPR ranged from three to twelve, according to the quantitative study. North Indian females had a maximum of 10 rugae (11.42%), while Nigerian females had a maximum of 12 rugae (17.14%). These rugae were seen in 3 (8.57%) of the North Indian female samples, which was the lowest number. The lowest rugae count in Nigerian females was five, and it was found in two (5.71%).Table 3.

Table 3: The rugae count distribution of North Indian and Nigerian female samples, from lowest to maximal

Gender	Total number of rugae in each palate (minimum three, maximum twelve)										Sample Size
	3	4	5	6	7	8	9	10	11	12	
North Indian female Count	3	4	0	7	6	5	6	4	0	0	35
Percentage within gender	8.57	11.42	0	20	17.14	14.28	17.14	11.42	0	0	100
Nigerian Female Count	0	0	2	5	3	3	6	4	6	6	35
Percentage within gender	0	0	5.71	14.28	8.57	8.57	17.14	11.42	17.14	17.14	100
Total	3	4	2	12	9	8	12	8	6	6	70
Percentage within gender	4.28	5.71	2.85	17.14	12.85	11.42	17.14	11.42	8.57	8.57	100

The total count of rugae in the Nigerian male and North Indian male right and left of MPR ranged from 3 to 12 rugae, according to the quantitative analysis. North Indian males had a maximum of 10 rugae (8.33%), while Nigerian males had a maximum of 12 rugae (17.14%). It was found in 3 (8.33%) of the North Indian male samples, with the lowest rugae count being 10. Rugae was found in 2 (5.71%) of Nigerian males, with the lowest count being 5. Table 4

Table 4. The rugae count distribution of the male samples from Nigeria and North India, from lowest to maximum

Gender	Total number of rugae in each palate (minimum three, maximum twelve)										Sample Size
	3	4	5	6	7	8	9	10	11	12	
North Indian Male Count	4	5	4	5	4	6	5	3	0	0	36
Percentage within gender	11.11	13.88	11.11	13.88	11.11	16.66	13.88	8.33	0	0	71
Nigerian Female Count	0	0	2	5	3	3	6	4	6	6	36
Percentage within gender	0	0	5.71	14.28	8.57	8.57	17.14	11.42	17.14	17.14	100
Total Count	4	5	6	10	7	9	11	7	6	6	71
Percentage within gender	5.63	7.04	8.45	14.08	9.85	12.67	15.49	9.85	8.45	8.45	100

DISCUSSION

Palatal rugae patterns are mostly used in forensics to determine the ethnic origin and identify of an individual. In forensic odontology, rugoscopy is still a relatively new technique. It wasn't until 1955 that Lysell[12,13] provided a precise taxonomy of palatal rugae, even though Winslow described them in 1753 and Harrison Allen[12,14] proposed using them for personal identification in 1889. Later researchers such as Kcndrick and Peavy (1967). Palatal rugae were categorised by Thomas (1972), Comoy (1973), Bamberadeniya (1978), and van der Linden (1978)[12-15] Thomas CJ and Kotze TJvW revised Lysell's (1955) categorisation in 1983, and it is now acknowledged as the most often used one. After being modified by Thomas CJ and Kotze TJvW in 1983, it is thought to be the most commonly used classification[13] Forensic odontology has examined palatal rugae for a variety of reasons, chief among them being the identification of individuals. Palate rugae have been demonstrated to be unique by numerous studies, including Carrea (1938), Lysell (1955),

Sassouni (1957), and English *et al*. (1988)[12,13,15,16] Moreover, rugae have been demonstrated to retain their shape throughout their lifetimes[17] It is not impacted by heat, chemicals, disease, or stress, and its structure and design stay the same. In the case that Palatal rugae are lost, they are carefully reproduced in their original habitat[18-20] In our study revealed that in North Indian male and female have the maximum rugae counting are 10 but while for Nigerian have the maximum rugae counting are 12. In North Indian males, the rugae count was the lowest at 10, and it was found in 3 (8.33%), while in North Indian females, it was found in 3 (8.57%) and in Nigerian males and females, it was found in 2 (5.71%).

CONCLUSION

Palatal rugae are anatomical formations that have use in anthropology, medicine, and forensics. However, there isn't a standard process for grading and keeping data records. This classification is advantageous since the rugae are categorised according to length. The function of palatal rugae in forensic identification needs to be confirmed by more research with a bigger sample size. For additional research to validate the function of palatal rugae in forensic identification, a larger sample size is needed.

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