

TECHNICAL NOTE

ODONTOLOGY

Carlos Santos,¹ D.M.D. and Inês Morais Caldas,^{1,2} Ph.D.

Palatal Rugae Pattern in a Portuguese Population: A Preliminary Analysis

ABSTRACT: Palatal rugae have been related with specific racial groups and are said to be useful in sex discrimination. This work aimed to characterize the palatal rugae patterns in a Portuguese population. Fifty plaster casts were examined for first and third rugae shape evaluation; shape, frequency, and association with sex were studied. In females, the most prevalent first rugae were the straight type on the right and the curve type on the left; in males, the straight type was the most prevalent on both sides. The most frequent third rugae type was sinuous on both sides, in both sexes. No significant sexual dimorphism in rugae shape was found ($p > 0.05$). When comparing these results with those from other investigations, it was clear that a particular rugae pattern could be established for different ethnic groups. However, the small sample size justifies further work in larger samples to validate these findings.

KEYWORDS: forensic science, forensic odontology, palatal rugae pattern, rugoscopy, human identification, sexual dimorphism, geographic origin

To best perform its functions, the oral mucosa must maintain a smooth surface. However, there are a few exceptions such as the dorsal surface of the tongue and the anterior portion of the palatal mucosa, which present a system of palatal rugae firmly attached to the underlying bone structures (1). The rugae are transverse ridges present on the anterior palatal third, just behind the incisive papilla, on both sides of the median palatine raphe (2). These rugae originate from hard connective tissue and are covered by stratified epithelia; their purposes are to facilitate food displacement through the oral cavity, to participate in the chewing process, and to contribute to the perception of taste (3).

The palatal rugae are formed in the third month *in utero*; once formed, they remain stable throughout a person's life, not undergoing any changes, except those related with length owing to the normal growth (4). In humans, there is no bilateral symmetry in the number of primary rugae or in their distribution with respect to the midline (5).

The use of palatal rugae can be useful in human identification, because these structures are unique to an individual, fairly stable throughout a person's life, and easily classified at low cost (6,7). Palatal rugae may represent the only oral structure useful in the identification of edentulous people (8).

The study of palatal rugae to establish a person's identity is called palatoscopy or palatal rugoscopy (1,7,9–11). All rugae are suitable for assessment; however, they do not possess the same value in human identification because the level of stability varies. Some authors claim that the first

palatal rugae are the most stable (1,12), whereas others point to third palatal rugae as the most stable reference (1,13–15). The issue remains controversial (16).

The aim of this investigation was to contribute to human identification using palatal rugoscopy by characterizing the palatal rugae pattern in a Portuguese population. Because it remains unclear which rugae is the most important, both the first and third were studied.

Methodology

The sample included 50 plaster casts, equally distributed among male and female Portuguese patients attending the Faculty of Dental Medicine of Porto University.

Rugae were delineated using a sharp graphite pencil under adequate light and magnification and described according to the classification of Basauri (Table 1) (17,18) as “point,” “straight,” “angle,” “sinuous,” “curve,” “circle,” or “polymorphous.” Rugae observations were repeated on a set of 15 randomly selected casts to compensate for potential intra-observer variation. Studies of frequency were made for the first and the third rugae (right and left sides). The association between rugae shape and sex was tested using chi-squared analysis ($p < 0.05$) using the SPSS 15.0 statistical package (SPSS Inc., Chicago, IL).

Results

Straight rugae were the most prevalent form of first rugae, on both the right and left sides; sinuous rugae were the most prevalent type of third rugae on both sides; “point” and “angle” configurations were not found in this sample (Table 2).

In females, the most prevalent first rugae were the straight type on the right and the curve type on the left; in males, the straight type was the most prevalent on both sides (Table 3).

¹Dental Medicine Faculty of Porto University, Faculdade de Medicina Dentária da Universidade do Porto, Rua Dr. Manuel Pereira da Silva, 4200-393 Porto, Portugal.

²Center of Forensic Sciences (CCF/FCT), Associação Centro de Ciências Forenses, Largo da Sé Nova, INML IP, 3000-213 Coimbra, Portugal.

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Table 1—Basauri classification.

Rugae Classification	Rugae Anatomy
A1	Point
B2	Line
C3	Angle
D4	Sinuuous
E5	Curve
F6	Circle
X7	Polymorphic

TABLE 2—Frequency of first and third rugae shapes.

	1st Right <i>n</i> (%)	1st Left <i>n</i> (%)	3rd Right <i>n</i> (%)	3rd Left <i>n</i> (%)
A1	0 (0)	0 (0)	0 (0)	0 (0)
B2	29 (58)	25 (50)	10 (20)	13 (26)
C3	0 (0)	0 (0)	0 (0)	0 (0)
D4	3 (6)	4 (8)	38 (76)	34 (68)
E5	13 (26)	17 (34)	2 (4)	3 (6)
F6	2 (4)	1 (2)	0 (0)	0 (0)
X7	3 (6)	3 (6)	0 (0)	0 (0)

TABLE 3—Frequency of first rugae shape according to sex.

	Males		Females	
	1st Right <i>n</i>	1st Left <i>n</i>	1st Right <i>n</i>	1st Left <i>n</i>
A1	0	0	0	0
B2	17	16	12	9
C3	0	0	0	0
D4	0	1	3	3
E5	6	5	7	12
F6	2	1	0	0
X7	0	2	3	1

TABLE 4—Frequency of third rugae shape according to sex.

	Males		Females	
	3rd Right <i>n</i>	3rd Left <i>n</i>	3rd Right <i>n</i>	3rd Left <i>n</i>
A1	0	0	0	0
B2	8	7	2	6
C3	0	0	0	0
D4	15	16	23	18
E5	2	2	0	1
F6	0	0	0	0
X7	0	0	0	0

TABLE 5—Relationship between rugae shape and sex (p-values).

	1st Right	1st Left	3rd Right	3rd Left
<i>p</i> -Value	0.63	0.127	0.26	0.768

The most frequent third rugae type was the sinuous type on both sides in both males and females (Table 4). There was no significant relationship between rugae pattern and sex (Table 5).

Discussion

Palatine rugae are permanent and unique to each person and can be used to establish identity (17–19). Some authors have claimed that a particular rugae pattern can be established for different ethnic

groups (1,20–22); such patterns could be useful in identifying a person's geographic origin. Our results support this statement. In our sample, straight rugae were the most prevalent first rugae; conversely, curved and wavy rugae were found to be the most prevalent in two Indian populations (23). In a study performed by Kapali et al. (21) in Australians, straight rugae were found to be less common, suggesting, again, the existence of different rugae patterns among various population groups.

Our investigation concluded that no significant relationship between sex and rugae pattern exists. These results are in agreement with those presented by Kashima et al. (cited by Manashvini et al. [1]), which revealed no significant differences in rugae pattern between sexes. Kapali et al. (21) stated that rugae analysis failed to reveal significant differences between sexes. These results contrasted with those obtained by Dohke and Osato (24), who reported fewer rugae in females than in males. Shetty et al. (20) also referred to differences in rugae number between males and females, as did Sharma et al. (6), who also reported the existence of a greater number of rugae in males. These differences may be explained by the use of different methodologies. In the present investigation, the rugoscopic pattern was studied, whereas in those conducted by Dohke and Osato (24), Shetty et al. (20), and Sharma et al. (6), the number of rugae was analyzed. It may be that rugae pattern is not dimorphic but that rugae number is. More studies, with larger samples, are needed to substantiate this statement.

Conclusion

Palatal rugae shape was analyzed in a Portuguese population. It was found that the straight shape was the most prevalent first rugae type, whereas the sinuous shape was the most prevalent third rugae type, for both males and females. The lack of any sexual dimorphism in the rugae pattern was confirmed, and a possible difference in palatal rugae shape according to geographic origin was suggested. However, these interpretations are precluded by the small sample size, and further studies involving larger samples are required.

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Additional information and reprint requests:

Inês Morais Caldas, Ph.D.

Professor

Dental Medicine Faculty of Porto University

Faculdade de Medicina Dentária da Universidade do Porto

Rua Dr. Manuel Pereira da Silva

4200-393 Porto

Portugal

E-mail: icaldas@fmd.up.pt