

## Qualitative and Quantitative Analysis of Palatal Rugae in 12-27 Years Age Group

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### Abstract

Palatoscopy or palatal rugoscopy is the study of palatal rugae. Palatal rugae were first described by Winslow in 1753. Palatal rugae have been considered relevant for human identification due to its unique for each individual. *Aims and Objectives:* Analyse the patterns of palatal rugae for number, size and shape on dental cast of 50 subjects and to compare the rugae patterns in males and females. *Method:* Palatal rugae were analysed by Lysell, Thomas and Kotze Classification. *Conclusion:* Within the limitations of the present study it may be concluded that rugae pattern are highly individualistic and can be used as a supplementary method for personal identification.

**Keywords:** Palatal Rugae; Shape; Size; Numbers; Gender.

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### Introduction

“Forensic odontology is a Branch of dentistry which deals with the appropriate handling and examination of dental evidence and with the proper evaluation and presentation of dental findings in the interest of justice”. The various identification methods employed in forensic odontology include- Bite marks, Dental radiographs, Dental photographs, Cheiloscopy, Rugoscopy, etc. [1]. According to the Glossary of Prosthodontic Terms, “Rugae are anatomical folds or wrinkles (usually used in the plural sense); the irregular fibrous connective tissue located on the anterior third of the palate”. They are also called “plica palatinae” or “rugae palatine”. Palatal rugae (rugae palatinae or plicae palatinae transversae) refer to a series of transverse ridges on the anterior part of the palatal mucosa on each side of the median palatal raphe and behind the incisive papillae. According to a histological study of the development in mice, palatal rugae develop in the third month of intrauterine life as localized regions of epithelial proliferation and thickening even before the elevation

of the palatal shelves [2]. Later, fibroblasts and collagen fibers accumulate in the connective tissue beneath the thickened epithelium and attain a distinctive orientation [3]. Physiologically the palatal rugae aid in oral swallowing, taste perception, participate in speech, suction in children and in the medico-legal identification process [4]. It has been suggested that changes in the length of rugae with age result from underlying palatal growth [5, 6,7]. However, the anterior rugae do not increase in length after 10 years of age according to Van der Linden [8]. Other qualitative characteristics such as shape, direction and unification remain stable throughout life. Despite the ongoing problem of describing palatal rugae patterns qualitatively and quantitatively, their uniqueness to individuals has been recognized in forensic science as providing a potentially reliable source of identification [9].

Palatoscopy or palatal rugoscopy is the study of palatal rugae. Palatal rugae were first described by Winslow in 1753 [10]. Palatal rugae have been considered relevant for human identification due to its unique for each individual, being equivalent to the fingerprints, stability post mortem resistance, low utilization cost [1,10,11]. Hence palatoscopy can be of special interest in forensic odontology. The uniqueness of palatal rugae as an aid for personal identification was the sole objective of the study.

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*Aims and Objectives*

- Analyse the patterns of palatal rugae for number, size and shape on dental cast of 50 subjects.
- To compare the rugae patterns in males and females.

**Material and Method**

- A total number of 50 subjects were enrolled and divided into two groups depending on their gender (25 females and 25 males).
- Patients taken belonged to the age group of 12- 25 years and were registered for treatment in the Department of Orthodontics and Dentofacial Orthopedics at GDC & H, Mumbai.
- Maxillary impression of the subjects were made using an irreversible hydrocolloid (alginate) in a perforated impression tray.
- Cast were obtained using dental stone.
- Rugae patterns were delineated using sharp graphite pencil under adequate light and magnification and analyzed macroscopically. (Figure 1)
- Size measurements were done using a pointed divider and scale with 0.5 mm markings.

*Method of Identification*

*Number of Rugae*

The number of rugae were counted on right and

left side of palate in each subject and compared.

*Size of Rugae*

According to Lysell’s Classification [12,13]-

- Primary rugae- 5mm or more.
- Secondary rugae- 3-5mm
- Fragmentary rugae- 2-3mm
- Rugae less than 2mm were not taken into consideration.

*Shapes of Rugae*

According to Lysell, Thomas and Kotze Classification [12,13]

- Curved, straight, circular, wavy, unification-convergence and divergence.
- Various Shapes of Palatal Rugae (Figure 2).

*Statistical Analysis*

Data were collected and analyzed with SPSS software version 12.0. Two sample independent t-test, paired sample t-test and Chi-square test has been performed.

**Results**

1. Comparison in Total Number of Rugae in Males and Females.

- Total 553 palatal rugae - observed in 50 subjects.
- Average no of rugae in each individual was 11.06

**Table 1:** Comparison in total number of rugae in males and females

Gender	Total No. Subjects	Rugae on Rt. Side	Rugae on Lt. Side	Total No. of Rugae	Avg. No. of Rugae
Female	25	132	134	266	10.64
Male	25	146	141	287	11.48
Total	50	278	275	553	11.06

**Table 2:** Comparison of shape of total number of rugae in males and females

Gender	Straight	Curved	Wavy	Circular	Converging	Diverging
Male	45	57	147	3	6	8
Female	57	66	150	4	3	12
Total	92	123	197	7	9	20
%	17.54	22.24	53.7	1.26	1.63	3.62
P Value	0.0003	0.0004	0.0004	<0.001	<0.001	<0.001

**Table 3:** Comparison of size of total number of rugae in males and females

Gender	Avg. Length on Rt. Side	Avg. Length on Lt. Side	Avg. Length on Both Side
Female	8.56	8.71	8.63
Male	8.23	8.72	8.48

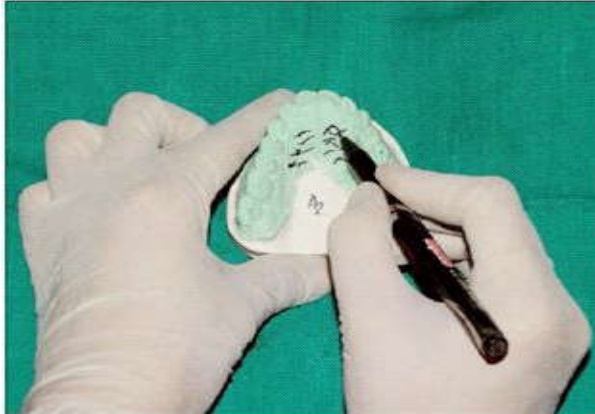


Fig. 1: Maxillary cast with different shapes of rugae

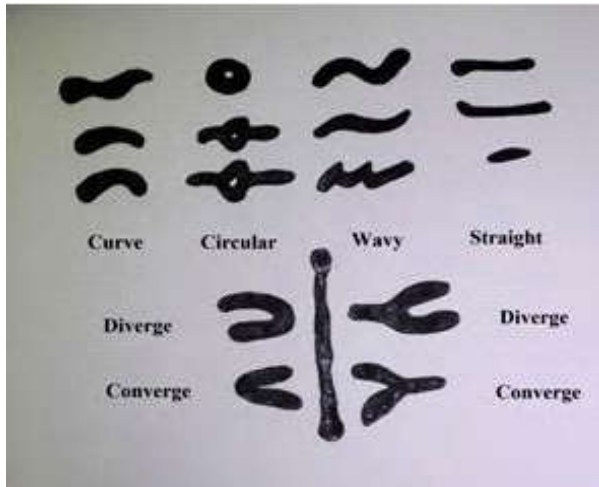


Fig. 2: Various Shapes of Palatal Rugae

(i.e. 5-6 rugae on each side of the palate).

- In 25 females -total 266 rugae were identified , mean value in each female 10.64.
- In 25 males - total 287 rugae were identified ,mean value in each male 11.48.
- Maximum number of rugae observed was 19 and minimum was 5.
- The above study reveals that the number of rugae on the right and left sides in males is slightly more compared to that in females. This is similar finding with Dennis E. O. Eboh. [14].

Statically result was not significant, this can be attributed to less number of samples in present study.

### 2. Comparison of Different Shapes of Rugae in Males and Females.

- Out of the total 553 rugae in 50 subjects.
- 297 were Wavy type -53.71% of the total rugae shapes - which were maximum in number
- Curved type - found to be 123 in number -22.24%

- Straight type - 97 in number - 17.54%
- Unification diverging type -20 in number - 3.62%
- Unification convergent type -9 in number -1.63%
- Circular type-7 in number - 1.26%
- Most common shape observed is of wavy type.
- Circular and unification converging are the least common shapes.
- Also females show a higher number of convergent shapes compared to the males.

Similar result was given by Fahmi et al. [15] and Saraf et al. [16].

Statically significant difference was found among different shape of rugae (Chi-square test, p value <0.0001)

### 3. Comparison in Size of Rugae (Length in Mm) in Males and Females.

- Average size of palatal rugae of 50 subjects - 8.55mm
- Average size in females - 8.63mm
- Average size in males - 8.48mm.
- Average length in both genders was comparatively more on the left side of the mid-palatine raphe.
- Average length on right side in males was significantly less compared to the right side in females.

Studies conducted by Fahmi et. al. [14] and Kapali et al. [16] concluded that average number as well as size of rugae did not show significant differences in males and females and on the right and left side of palate which is in contrast to our study.

Statically result was not significant, this can be attributed to less number of samples in present study.

### Discussion

In the present study quantitative and qualitative assessment reveals that the number of rugae on the right and left sides in males is slightly more compared to that in females. This is similar finding with Dennis E. O. Eboh. [14]. Most common shape observed is of wavy type. Circular and unification converging are the least common shapes. Also females show a higher number of convergent shapes compared to the males. Similar result was given by Fahmi et al [15] and Saraf et al. [16].

Average length in both genders was comparatively more on the left side of the mid-palatine raphe. Average length on right side in males was

significantly less compared to the right side in females. Studies conducted by Fahmi et al [15] and Kapali et al [17] and concluded that average number as well as size of rugae did not show significant differences in males and females and on the right and left side of palate which is in contrast to our study.

Once RUGAE are formed they, may experience changes in their size due to growth of the palate, but its shape is maintained. Usually form, layout and characteristics are not affected by the eruption of the teeth or their loss, but sometimes palatal rugae adjacent to the alveolar arch slightly change their position after tooth extraction. Some events may contribute to changes in the pattern of palatal rugae, such as finger sucking in childhood and persistent pressure due to orthodontic treatment. Its design and structure are unchanged and are not altered by chemicals, heat, disease or trauma, or, if palatal rugae are destroyed, are reproduced exactly on the same site [18]. Despite the ongoing problem of describing palatal rugae patterns qualitatively and quantitatively, their uniqueness to individuals has been recognized in forensic science as providing a potentially reliable source of identification.

### Conclusion

No two palates are alike in their configuration. Within the limitations of the present study it may be concluded that rugae pattern are highly individualistic and can be used as a supplementary method for personal identification. Further research with a large sample size and a wide age range may be indicated in order to substantiate the present study findings.

#### Potential Implications

- It can be used as necroidentification technique.
- In fact, the Brazilian Aeronautic Ministry demands palatal rugoscopy of all its pilots in order to ensure their identification in case of accidents.
- Palatal rugae can be used to assess the amount of anteroposterior tooth movement, because they remain stable during a person's life
- Also in the identification of submucosal clefts

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