

Analysis of the Palatal Rugae Pattern in Both Genders: An Institutional-based Study

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ABSTRACT

Palatal rugae are unique anatomical structures located on the anterior part of the palatal mucosa and have been recognized for their potential use in forensic identification due to their uniqueness and resistance to trauma. This institutional-based study aims to analyze and compare the pattern of palatal rugae among male and female individuals to assess gender-based differences. A total of 134 subjects were selected from the institutional database. Maxillary impressions were taken and rugae patterns were recorded and classified based on their number, shape (straight, wavy, curved, circular), and unification. The data were statistically analyzed to identify any significant sexual dimorphism. Results demonstrated. This study concludes that palatal rugae patterns show considerable variability between genders and may serve as a supplementary tool in personal identification, especially in forensic scenarios where other means are unavailable.

Keywords: Dental Cast, Forensic Dentistry, Gender, Palatal Rugae Pattern.

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Introduction

Palatal rugae form a pattern in the anterior part of the palate that is considered unique to an individual, analogous to fingerprints. They are irregular, asymmetric ridges of mucous membrane extending lateral from the incisive papilla and the anterior part of the median palatal raphe, which is just behind the maxillary central incisor teeth.

The palatal rugae appear towards the third month of intrauterine life, from the covering connective tissue in the palatine process of the maxillary bone, and its development and growth is mutually controlled by epithelial-mesenchymal interactions, where specific extracellular matrix molecules are spatiotemporally expressed during development. Once they are formed they may

experience changes in their size due to growth of the palate, but its shape is maintained.

Palatoscopy or palatal rugoscopy is the name given to the study of palatal rugae in order to establish a person's identity. The palatal rugae are shielded from physical damage and temperature changes by their anatomical placement within the oral cavity within the blanket of cheeks, lips, a buccal pad of fat, and dento alveolar apparatus. Thus, it can be utilized as a trustworthy reference point during forensic identification. Palatal rugae identification can have a significant role in forensic identification during mass disasters, terrorist acts, traffic accidents, and burnt victims, where it is difficult to use normal identification methods. Nowadays, It is a widely used method in the recognition of

human identity due to its uniqueness in the course, direction, length, form, position, and enduring nature against disintegration. Its easy applicability, cost-effectiveness, and prompt results can be applied to festering, scorched bodies and in the absence of missing upper limbs and fingers. There are different ways to analyze the palatal rugae. Intraoral inspection is probably the most used and most easy, economic method. However, this can create difficulties if a future comparative review is required. A more detailed and accurate and the need to preserve evidence may justify the use of photographs or impressions.

Therefore, this study aims to analyse the Rugae pattern in patients who are visiting our institution and identify their number, shape, direction, and size according to their gender.

Aim and Objectives

The study was aimed to identify Rugae pattern in terms of their number, shape and size and differentiating them according to gender. Inclusion criteria were pre-treatment study cast of pediatric and adult patient undergoing treatment for orthodontic, pedodontic or implant procedures. Exclusion criteria include patient with congenital defect in palate, patients diagnosed for orthognathic treatment, patients with palatal asymmetries or patients with history of palatal surgery or orofacial tumors.

Material and Method

The study was an observational study conducted in the department of Oral and Maxillofacial

surgery, IDS Bareilly, Uttar Pradesh, India. The sample included study cast of hundred and thirty four patients who have undergone treatment in the department of Oral and Maxillofacial Surgery, Orthodontics, Paediatric and Preventive dentistry which were randomly selected after following exclusion and inclusion criteria.

Method of identification

Diagnostic Study casts, which were made of class III dental stones, of patients were taken from different departments, and analysis was done accordingly on them. Casts were numbered according to patient and then analysis was started. The rugae patterns were marked with black graphite pencil and then were analysed by using the easiest, most practical, and standardised technique of Thomas and Kotze classification. It is based on the parameters like total number of rugae, the predominant shape of rugae, and the predominant direction of rugae. A number of each rugae was counted on the left as well as right side of mid palatal raphe. The length of rugae was evaluated as primary (>5 mm), secondary (3-5 mm) and fragmentary(<5mm), and it was analysed using a simple thread placed on single rugae and placing a divider over it and then measuring the length of that thread on the scale. The shape of the rugae was recorded as curved, wavy, straight, converging, and diverging. The direction of rugae was evaluated by measuring the angle formed by the line joining its origin and termination and the line perpendicular to the median raphe and classified as forwardly directed rugae, backwardly directed rugae, and perpendicular rugae.

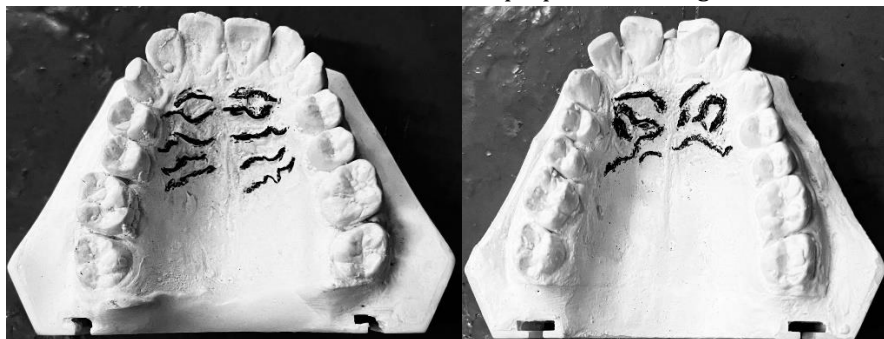


Figure: 1 Different types of palatal Rugae shape.

Result

Incidence of different shapes of rugae pattern is described Wavy and curved rugae were the most prevalent forms in female groups, followed by straight rugae as described in Table 1. The forward direction of the pattern was most prevalent and common seen in males and then in

females. Curvy and wavy shapes were most common in both groups followed by straight patterns. In the male group converging patterns were last seen and in the female diverging patterns were seen less. Most commonly six to eight Ruga were seen in both groups.

Shapes**For Right Side**

Shapes	Male	Female	Total
Curved	58	103	161
Wavy	91	172	263
Straight	30	69	99
Convergent	3	3	6
Divergent	1	0	1
Total	183	347	530

For Left Side

Shapes	Male	Female	Total
Curved	78	136	214
wavy	73	168	241
Straight	27	60	87
convergent	2	1	3
Divergent	1	0	1
Total	181	365	546

Direction**For Right Side**

Direction	Male	Female	Total
Backward	69	137	206
Forward	57	115	172
Perpendicular	58	94	152
Total	184	346	530

For Left Side

Direction	Male	Female	Total
Backward	43	80	123
Forward	74	149	223
Perpendicular	63	136	199
Total	180	365	545

Length**For Right Side**

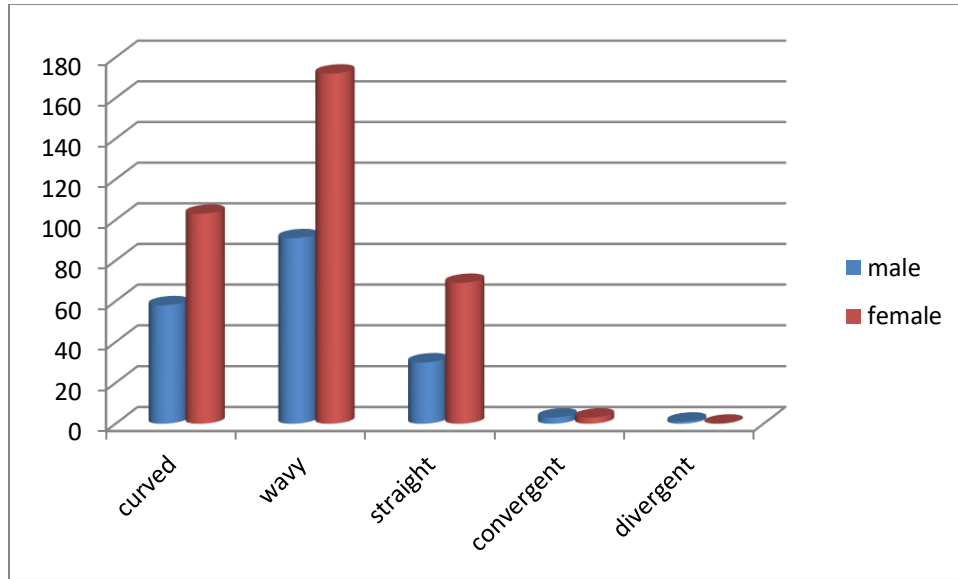
Length	Male	Female	Total
Shortest	10	21	31
Longest	0	1	1
Total	10	22	32

For Left Side

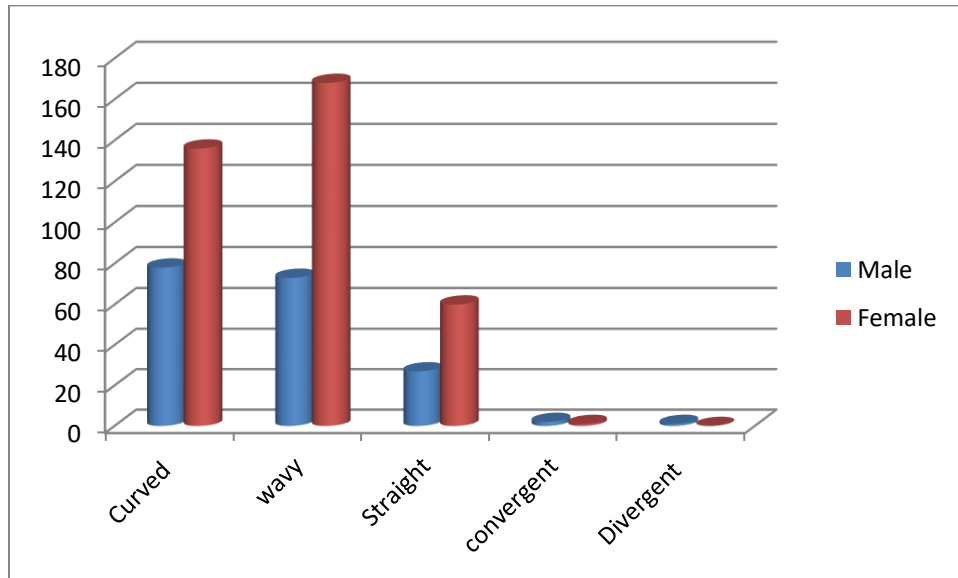
Length	Male	Female	Total
Shortest	10	19	29
Longest	1	0	1
Total	11	19	30

Total number of rugae		Gender		Total
		F	M	
1.	6.00	12	9	21
2.	7.00	11	8	19
3.	8.00	33	17	50
4.	9.00	19	3	22
5.	10.00	12	9	21
6	12.00	1	0	1
Total		88	46	134

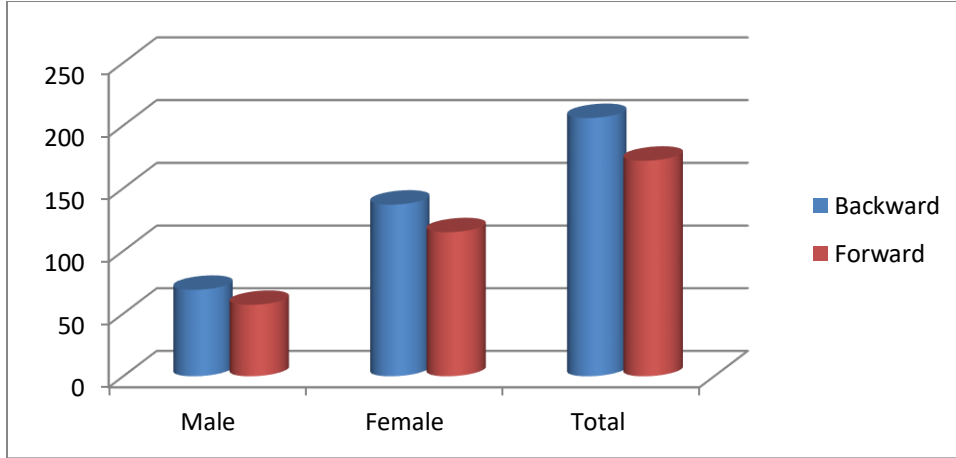
**Shapes
For Right Side**



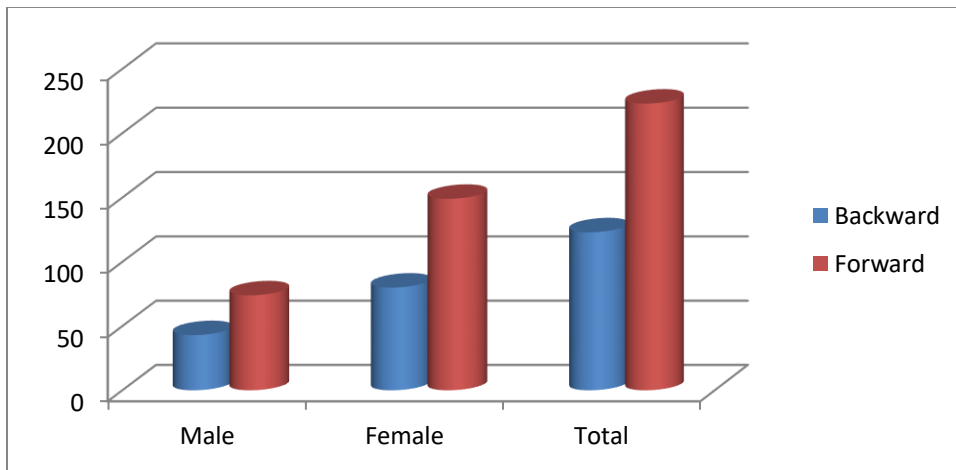
For Left Side



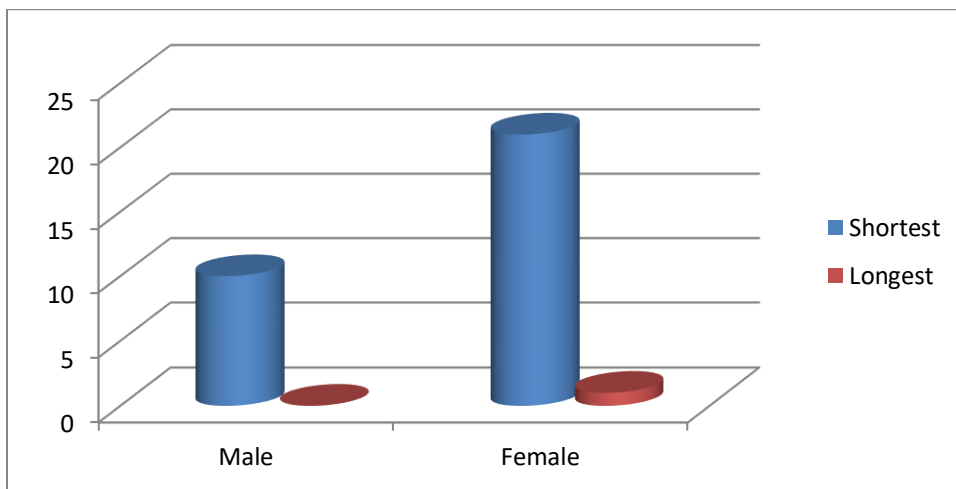
**Direction
For Right Side**



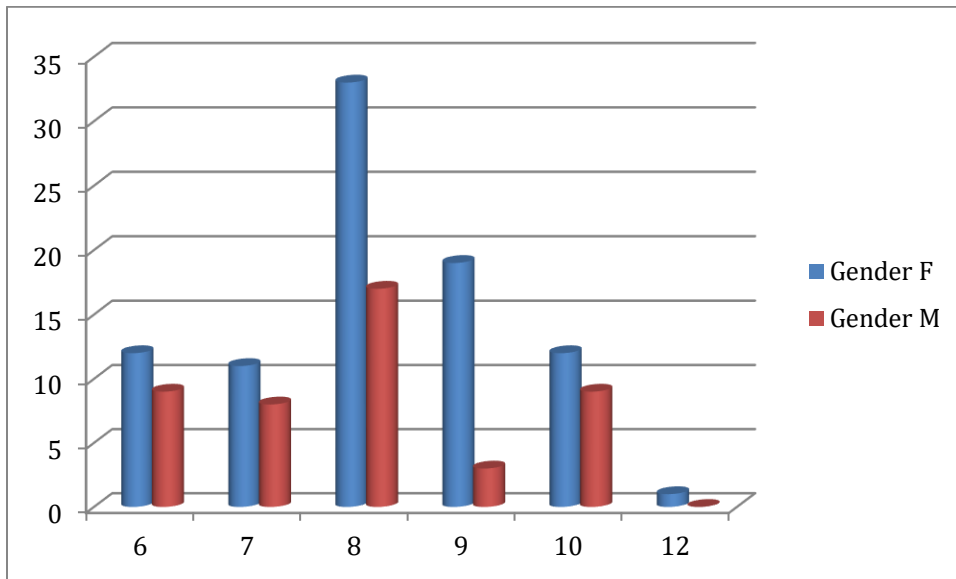
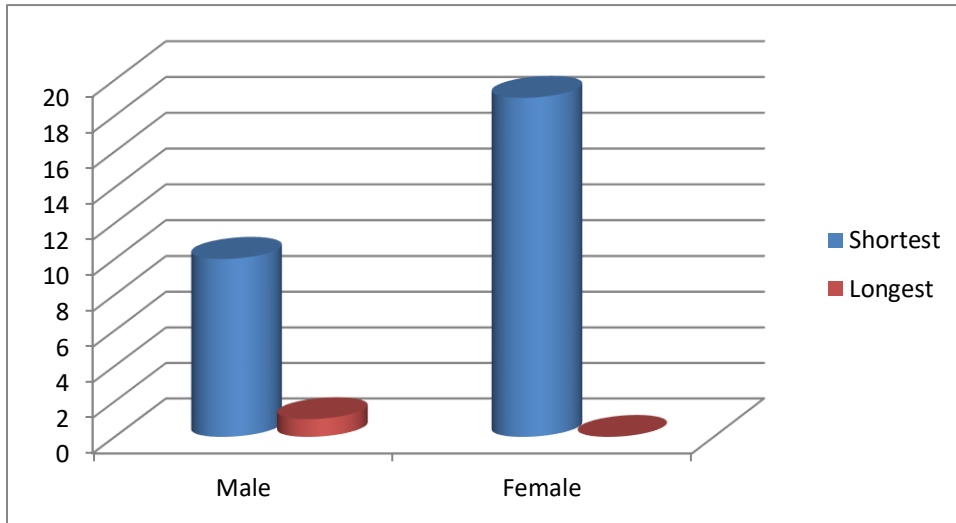
For Left Side



**Length
For Right Side**



For Left Side



Total Number of Rugae among Both the Gender

Discussion

The present study aimed to evaluate the palatal rugae patterns in males and females to explore any significant gender-based differences that could support their use in forensic identification. Palatal rugae are considered stable anatomical landmarks that remain unchanged after growth and are resistant to trauma, making them valuable for personal identification, especially in cases where dental records or fingerprints are unavailable.

Our findings revealed both similarities and distinctions in the rugae patterns between genders. Wavy and curved rugae were found to be the most common patterns across both groups, which is consistent with prior studies conducted in various populations. However, the frequency of specific patterns such as curly and wavy showed variation in both the groups being dominant to other, e.g., Curvy patterns were more predominant in males, and Wavy were more in females, suggesting a potential for gender differentiation.

In this study, curvy and wavy pattern was found to be more common in both men and women which was similar to the study conducted by Kumar et al. and Surekha et al. showed the predominance of curved and wavy patterns of rugae in most populations. These results were in contrast to a study conducted by Balgi et al where straight patterns were most common.

The number and length of rugae also showed slight differences, though not always statistically significant. Some studies have reported that females tend to have a higher number of rugae, while others found the opposite. These variations might be attributed to ethnic, genetic, and environmental factors, highlighting the need for population-specific data when using palatal rugae in forensic cases.

Importantly, while palatal rugae patterns alone may not be definitive for sex determination, they can act as a supportive method when used alongside other forensic tools. The simplicity of obtaining palatal impressions and the non-invasive nature of the procedure makes it a practical method in forensic and anthropological contexts.

Conclusion

Curvy and Wavy pattern is the most common pattern in both groups, and the mean number of palatal rugae and length is slightly more in females than that in males. As this study had a limited sample size of 134 subjects, it will be beneficial to conduct studies with a larger sample and to compare with ethnic groups.

Limitations of this study include the limited sample size and its confinement to a single institution, which may affect the generalizability of the results. Future studies should consider larger, more diverse populations and possibly incorporate digital analysis methods for more precise classification.

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