

## ORIGINAL ARTICLE

# ANALYSIS OF PALATAL RUGAE PATTERNS IN POPULATION OF MALWA REGION OF PUNJAB: A FORENSIC STUDY

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### ABSTRACT:

**Background:** Palatal rugae consist of three to seven ridges radiating out from the incisive papilla on the anterior most part of the palate. These rugae pattern can be used in various fields such as sex determination, orthodontics and forensic identification. **Aim:** To establish the individual's identity based on the palatal rugae patterns. **Materials and Methods:** The study group consisted of 200 study models all of whom were subjects above 20 years old. Martin dos Santos' classification was followed to assess the individuality of rugae pattern. **Results:** Each individual had different set of rugae patterns which are not symmetrical, both in number and in its distribution. **Conclusion:** In the light of results of our study, palatal rugae can be used as one of the effective tools in forensic field for individual identification.

**Keywords:** Palatoscopy, Rugae pattern , Rugoscopy

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## I NTRODUCTION

Palatoscopy is the study of palatal rugae for the establishment of individual identity of a person.<sup>1</sup> Palatal rugae are the ridges on the anterior part of the palatal mucosa on each side of the medial palatal raphae and behind the incisive papilla.<sup>2</sup>

Allen in 1889 was the first one who suggested the use of palatal rugae as a method of identification of an individual.<sup>3</sup> The palatal rugae are consistent during the life period like the fingerprints and are protected from trauma and high temperatures owing to its internal position in the oral cavity, and protected by the lips, cheeks, tongue, teeth and bone, and prosthetic devices.<sup>4</sup>

Rugae consist of around 37 ridge and oblique ridges anatomically that radiate out tangentially from the incisive papillae. The rugae are stratified squamous when seen histologically; mainly para keratinized epithelium on a connective tissue base, similar to the adjacent tissue of the palate.<sup>5</sup> The

palatal rugae is often used as a necro identification technique as it can resist decomposition for up to 7 days.<sup>6</sup>

Various studies in the past demonstrates that no two individual's rugae patterns are similar and alike in their configuration [Figure 1] and no change occurs in the characteristic rugae pattern of the palate as a result of growth.<sup>7-10</sup> Keeping all this background data, the present study was undertaken to investigate the role of rugae pattern in personal identification.

## MATERIALS AND METHODS

The study consisted of 200 healthy subjects aged 20 years and above selected randomly from the Malwa region of Punjab. The sample size comprised of 100 males and 100 females. Subjects with history of oral surgical procedures, congenital anomalies/malformations, allergic to impression material, present active oral lesions, scars and trauma of the palate were excluded from the study.

Primary impression material (Addition silicone) was used as an impression material. Informed consent was obtained from each subject and primary impression was taken and a cast model was made from the impression using dental stone. Black graphite pencil was used to highlight the palatal rugae pattern and were analyzed following the classification of Santos<sup>7</sup>.

This classification indicates and characterizes the following:

- **One Initial rugae;** the most anterior one on the right side is represented by a capital letter
- **Several complementary rugae;** the other right rugae are represented by numbers
- **One sub-initial rugae;** the most anterior one on the left side is represented by a capital letter
- **Several sub-complimentary rugae;** the other left rugae are represented by numbers.

**Table 1:** Matins dos santos' palatal rugae classification

Rugae type	Anterior position	Other positions
Point	P	0
Line	L	1
Curve	C	2
Angle	A	3
Circle	O	4
Sinuous	S	5
Bifurcated	B	6
Trifurcated	T	7
Interrupt	I	8
Anomaly	An	9

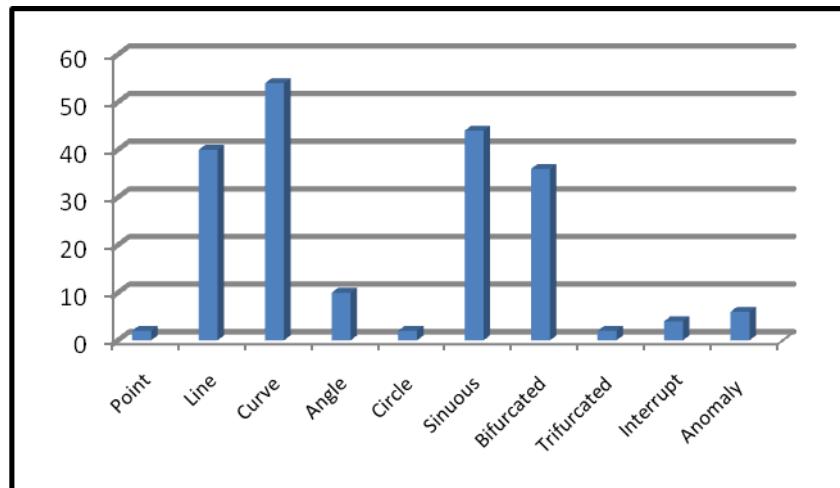
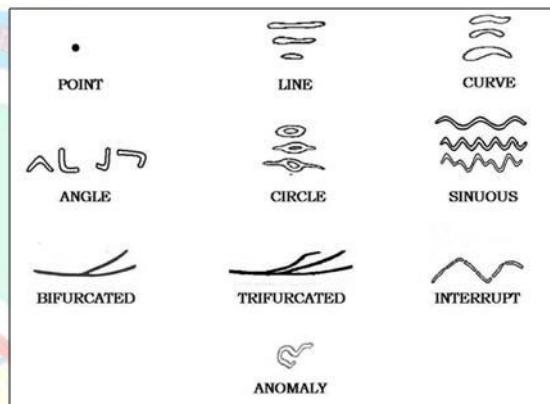
The classified types of rugae patterns were recorded and results tabulated.

The numbers and letters are given to each rugae based on its form enlisted in Table 1.(Modified from Caldas et al)<sup>8</sup>.

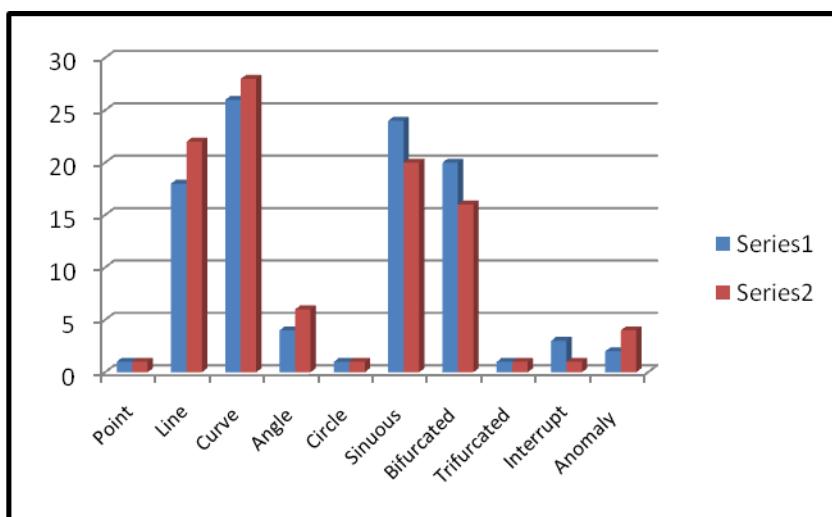
## RESULTS

All the 200 casts exhibited different and unique rugae patterns. Each individual had a unique and different set of rugae pattern in our study. Overall, the curve form (27 %) was the most common form of rugae pattern seen in our study in both the sexes. [Figure 2]. On comparing both the sexes, curve and sinuous forms were found to be common in males and curve and line forms were more common in females [Figure 3].

**Figure 1:** Different forms of palatal rugae



**Figure 2:** Distribution of forms of palatal rugae pattern



**Figure 3:** Distribution of forms of palatal rugae patterns among males (Series 1) and females (Series 2).

## DISCUSSION

Literature quotes numerous attempts aiming for identification of a reliable safe method for human identification that may allow recognition, avoidance or detection of errors and simultaneously preclude changes or alterations of numbers or individuals.<sup>12,13</sup> Facts show that there are certain limitations in identification by fingerprints, dental records and DNA in some forensic situations, and therefore, palatal rugae pattern of an individual may be considered as a useful adjunct tool for identification purposes.<sup>14,15</sup> In our present study, we didn't find any single specific pattern alone in an individual but appeared as a mixture of varying forms. Curve forms predominated were most commonly observed followed by line and sinuous forms. This is consistent with the results of Pretty et al, Ohtani et al. and Indira et al. who also observed different palatal rugae patterns.<sup>16-18</sup> Literature studies also states that rugae maintain a constant shape throughout life and may be specific to racial groups facilitating population identification.<sup>19-21</sup> Therefore, uniqueness of palatal rugae pattern makes it a characteristic of an individual and therefore helps in person identification.

Curve form was most common form observed in our study which is consistent with the findings of the study by Nayak *et al.* and Indira et al. It can therefore be concluded that certain rugae shapes are population specific.<sup>18,22</sup>

From the above results, we strongly suggest that palatal rugae pattern can be used in forensic field as a part of identification and investigation for antemortem and post-mortem cases.

However, we advocate that further studies should be conducted on individuals of different races,

family members, identical twins and with larger sample size for standardizing the palatoscopic principals.

## CONCLUSION

The use of palatal rugae pattern in forensic identification is advantageous because of its cost effectiveness, reliability, reproducibility. In the light of results of our study, it is sufficiently characteristic to discriminate between individuals because no two palates were similar in their rugae pattern. Hence, palatal rugae can be used as one of the effective tools in forensic field for individual identification.

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