

Analysis of Rugae Patterns and Arch Length in a Central Kerala Population: An Original Research

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Abstract:

Background: Literature states that no two palates are alike in their configuration and that the palatal print did not change with time or age. This unique property makes them ideal for the purpose of personal identification.

Materials and Methods: 82 patients (ages 16-25) were included in the study (40 males and 42 females). Casts were prepared from each individual impression, and the rugae length was measured using Vernier calipers. The arch length was analyzed with the help of brass wire. The results obtained were then statistically analyzed using SPSS software version 16.0.

Results: The mean length of the rugae was found to be 12.5732 mm (standard deviation [SD] = 1.90374), and the mean arch length was found to be 79.5427 mm (SD = 5.17544). The mean rugae length in males was found to be 13.05 mm (SD = 2.13277) and in females was 12.1190 mm (SD = 1.54923) showing no significant difference. The arch length in males (mean = 81.1 mm) and females (mean = 78.0595) failed to demonstrate any significant variation.

Conclusion: There was no significant statistical difference between both sexes in relation to the rugae pattern although there was a predominance of the curved pattern in males and straight in females. Even though the length of the rugae and arch length was slightly greater in males, the results were not statistically significant.

Key Words: Palatal rugae, Arch length, gender, rugae pattern, identification

Introduction

Forensic odontology can be defined as 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.¹ It is widely acknowledged that in some forensic situations there are limitations to the identification of the deceased by fingerprints, DNA, and dental records.² Gender determination is one of the important aspects of human identification as it helps in building the biological profile of unidentified human remains.³ One of the most important methods of assessing gender is anthropometry of the face and intraoral regions.

Palatal rugae (plica palatine transverse) refer to a series of transverse ridges on the anterior part of the palatal mucosa. These rugae are present on each side of the median palatal raphe and behind the incisive papillae.⁴ Palatal rugae have been shown to be highly individual and consistent in shape throughout life.⁵⁻⁹ The anatomical position also affords some protection in cases of incineration or trauma. It has been reported that no two palates are alike in their configuration and that the palatal print did not change with time or age.¹⁰

Materials and Methods

The study was conducted in at Mar Baselios Dental College, Kothamangalam, Kerala, India. The study included 82 patients between the ages of 16 and 25 years. They were divided into two groups based on gender, consisting of 42 females and 40 males. Those with congenital abnormalities, inflammation, trauma, and orthodontic treatment were not included in the study.

An irreversible hydrocolloid material and dentulous impression trays of suitable dimensions were used to record the maxillary impression. The impression was poured with Type III dental stone. The palatal rugae obtained on the stone cast were highlighted using 0.3 mm graphite pencil and were observed under adequate light and magnification.

The arch length was assessed by adapting a brass wire along the teeth and markings were made from the mesial aspect of one maxillary molar to the other. The marked area was measured by placing it against a metallic ruler.

For the means of recording the rugae length and shape, only the third rugae were analyzed for all 82 casts. The shape of the rugae was assessed based on the Thomas and Kotze classification, and the length was measured with the help of Vernier callipers (Figure 1).

The data obtained was tabulated and analyzed using SPSS software, Version 16.0. Cross tabulation was done to check the relationship between gender of the individual and shape of the rugae. This was followed by the application of *t*-test to analyze the difference in gender in relation to the length of the rugae and the maxillary arch length. Bi-variate correlation was also performed between the length of the arch and length of the rugae.

Results

A total sample size of 82 patients comprising of 40 males (48.8%) and 42 females (51.2%) was taken. On assessing the data collected regarding the shape of the third rugae, it was found that the straight form predominated in the sample size (34.1%) with circular being the least occurring (Graph 1). Cross tabulation revealed the most predominant pattern in males was curved (*n* = 17) and in females was straight (*n* = 18). But, on applying Pearson’s Chi-square test which yielded a value of 0.082 and based on it was concluded that there was no significant difference in the exhibition of rugae patterns between the two sexes. The gender distribution of the rugae patterns is depicted in Graph 2.

The mean length of the rugae was found to be 12.5732 mm (SD = 1.90374), and the mean arch length was found to be 79.5427 mm (SD = 5.17544). The mean rugae length in males was found to be 13.05 mm (SD = 2.13277) and in females was 12.1190 (SD = 1.54923) and no significant difference was found between the two. Similarly, arch length in males (mean = 81.1 mm) and females (mean = 78.0595) failed to demonstrate any significant variation.

Discussion

Palatal rugae are popularly considered to be stable structures that do not change during the life of the individual. They are protected from trauma and high temperatures by means of its unique anatomical position, and it is believed their stability defies even the use prosthetic appliances.¹¹

Palatal rugoscopy was introduced in 1932 by a Spanish investigator Troban Hermaso. Thomas and Kotze studied the rugae patterns in South African populations and found that rugae were unique to each ethnic group.⁶

English *et al.* stated that palatal rugae pattern are unique, and identification could be based on their comparison.⁸ In our study, we employed the third rugae for reference, as the previous studies put forward that the third palatal rugae pair, in particular, being the most stable reference. This is due to the fact these rugae being positioned near the molar region, are less susceptible to changes with tooth movement.^{5,12-15}

Despite the controversy about the stability of the characteristics of rugae and the extent of differences between ethnic groups

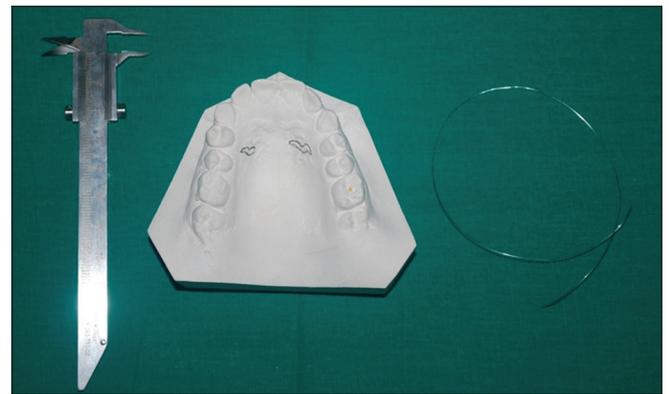
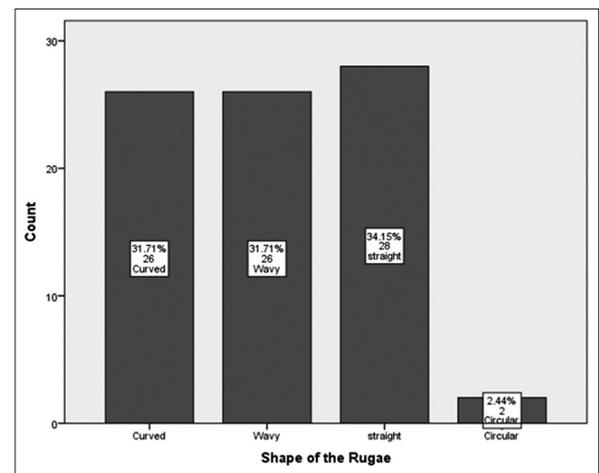
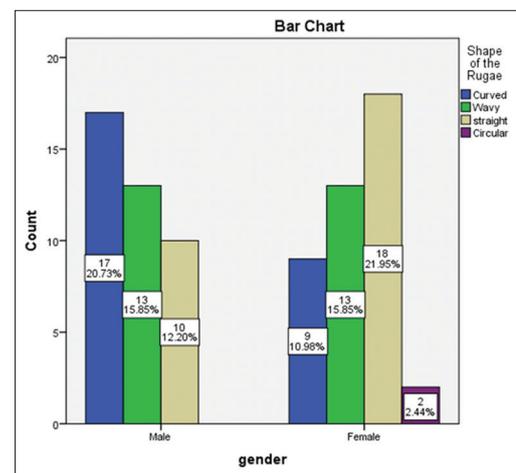


Figure 1: Armamentarium for the assessment of rugae pattern and arch length.



Graph 1: The shape of the rugae against the sample size.



Graph 2: The gender distribution of rugae patterns.

and sex, they have been recognized in the field of forensics as a potential source of identification.¹⁶

There was an overall predominance of straight forms followed by other forms. This is similar to the study done by Madhankumar *et al.*¹⁷ In our study, even though the predominant shape of the rugae was curved in males and

straight in females, similar to the studies reported by Bakkannavar *et al.* and Shetty and Premalatha *et al.*,^{18,19} there was no statistically significant difference in the exhibition of rugae patterns between the two sexes. Nayak *et al.*, in their study, between two Indian populations confirmed previous reports of lack of sex dimorphism.²⁰ In our study, we confirmed the evidence got from previous studies that rugae pattern could not effectively be used to discriminate between genders.

The study done by Chopra *et al.*, revealed that arch lengths of the males were greater than those of females.²¹ In our study also the arch length and rugae length were slightly greater in males when compared with females. However, this was not statistically significant.

Conclusion

Our study concluded that the predominant shape of the rugae in the study population was straight form. There was no significant statistical difference between both sexes in relation to the rugae pattern although there was a predominance of the curved pattern in males and straight in females. Even though the length of the rugae and arch length was slightly greater in males, the results were not statistically significant. But, as our study was conducted on a limited number of subjects, we believe further studies need to be done on a larger population for better validation of our findings.

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