Palatal Rugae As An Adjunct To Gender Differentiation In Forensic Identification

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Abstract: Aim: To determine gender difference in Palatal Rugae pattern among the population of Greater Noida. Materials: An irreversible hydrocolloid was used as an impression material on an appropriate perforated metal tray for the maxillary dental arch for all subjects. The impressions were then poured with Type III dental stone. Methods: A total of 60 Class I Dentate subjects (n=60) were chosen from among the patients arriving at the School of Dental Sciences, Dental Hospital Result: The present study shows a significant difference in the palatal rugae dimensions among male and female population of Greater Noida. Out of 30 male and 30 female subjects, the total number of rugae was found to be more in males than in females. A similar trend was observed in the mean value of rugae in males and females. The p value was found to be 0.436.Amongst males, curve type of rugae is the most predominant rugae type followed by wavy, straight and circular type. Conclusion: The study hereby concludes the significance of rugoscopy in the field of forensic odontology as well as gender identification in the population of greater noida.

IndexTerms: Palatal Rugae, Forensic odontology, Rugoscopy

I. INTRODUCTION

A subspecialty of dentistry known as forensic odontology deals with the proper handling, examination, and presentation of dental results in the service of justice. Within the full range of techniques used for medico-legal identification, forensic dentistry holds a significant place. [1]The identification of the deceased is essential for legal, social, and personal reasons as well as for certification of death. The most popular scientific techniques for forensic identification include DNA, fingerprint, and dental record comparisons. [2] While teeth are more durable, the use of dental records for identification may also prove to be ineffective because many antemortem dental records may be erroneous or incomplete. Limitations to the use of fingerprints exist in circumstances when the hands are burned or otherwise damaged. Additionally, dental work might have been done between the time a dental record was created and the persons passing. In the anterior portion of the palatal mucosa, behind the incisive papilla and on each side of the medial palatal raphae, there are ridges known as the palatal rugae. [1]It has been established that palatal rugae have a highly unique appearance and maintain it throughout life. In one study, 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. Even between twins, the studies indicated that the patterns are similar but not identical. [2] Kapali et al in their study did not reveal any significant differences in the number of primary rugae between Australian Aboriginal males and females. [3] However studies have indicated that distinct rugae patterns can be used as an alternative to not only identify the deceased but also as an adjunct to differentiate between genders of a given population. This can be further used in as an aid in census studies and for other forensic purposes. The main aim of this study is to determine whether or not there exists any gender difference in Palatal .Rugae pattern among the population of Greater Noida.

II. METHODS AND MATERIALS

The study was conducted at the Department of Oral Pathology and Microbiology, School of Dental Sciences , Sharda University.

1. Patient Selection

There were 30 men and 30 women in the 60 Class I Dentate subjects (n=60), chosen from among the patients arriving at the hospital. Each subject was of Indian descent. All patients were in good health and had no congenital alterations, inflammatory reactions, trauma, or orthodontic therapy. The subjects were informed relating to the process and formal authorization was acquired.

2. Impression

An irreversible hydrocolloid was used as an impression material on an appropriate perforated metal tray for the maxillary dental arch for all subjects. The impressions were then poured with Type III dental stone. All instructions by the manufacturer were followed such as water/powder ratio, vacuum mixing and use of vibrator. All casts were free of bubbles and void.

3. Method of Identification

The classification used for identification of Rugae Patterns used in this study is given by Thomas and Kotze and Kapali et al .These divisions comprise number, length, and shape and rugae unity. The Rugae pattern on the cast was emphasized with a black ink marker under a spotlight with a magnifying glass. A brass wire was placed on the rugae pattern and the length was measured.

The term "primary rugae" refers to rugae that are longer than 5 mm. Fragmentary rugae are those with a length of 2-3 mm, whereas secondary rugae are those with a length of 3-5 mm. Individual rugae were divided into four categories based on their shapes: curved, wavy, straight, and circular. Straight kinds ran nonstop from beginning to end. The softly curved form has a straightforward crescent shape. Rugae were categorised as curved if there was even the slightest indication of a bend at their termination or origin. The wavy rugae have a fundamental serpentine shape. Rugae had to exhibit a distinct continuous ring development in order to be labelled as circular.

4. Statistical Evaluation

The association between the attributes and comparison of the medians were determined using the Chi- Square test. The crucial value was set at a significance level of 5%. A logistic regression analysis (LRA) was carried out with sex (where Male=1 and Female=0) as the dependent variable and rugae shape as the independent variable in order to determine the accuracy of sex using rugae shapes. The statistical programme SPSS 10.0 was used.

5. Results

The intra-observer error was found to be negligible since the percentage concordance between repeat observations was found to exceed 95 percent with very few discrepancies involving the exclusion of secondary and fragmentary rugae, perhaps because of their size. Out of 30 male and 30 female subjects, the total number of rugae was found to be more in males than in females. A similar trend was observed in the mean value of rugae in males and females. The p value was found to be 0.436.Amongst males,
curve type of rugae is the most predominant rugae type followed by wavy, straight and circular type. Amongst female subjects there is a small difference in the number of wavy and curve type of rugae with wavy type being 99 in number and curve type being 97 in number. Straight and circular types of rugae pattern are found less in number amongst female subjects as compared to male subjects. Out of the total 284 rugae patterns recorded on male casts, 152 were between 5-10mm long while 137 were more
than 10 mm long. Casts of female subjects show a similar trend with 122 rugae being in the range of 5-10 mm and 104 rugae being in the range of more than 10 mm in length. Hence a total of 510 rugae were measured out of which 274 measured were between 5-10 mm long and 141 measured were more than 10 mm long. The $\chi 2$ value found was 4.702 and the p value was found to be 1.0.

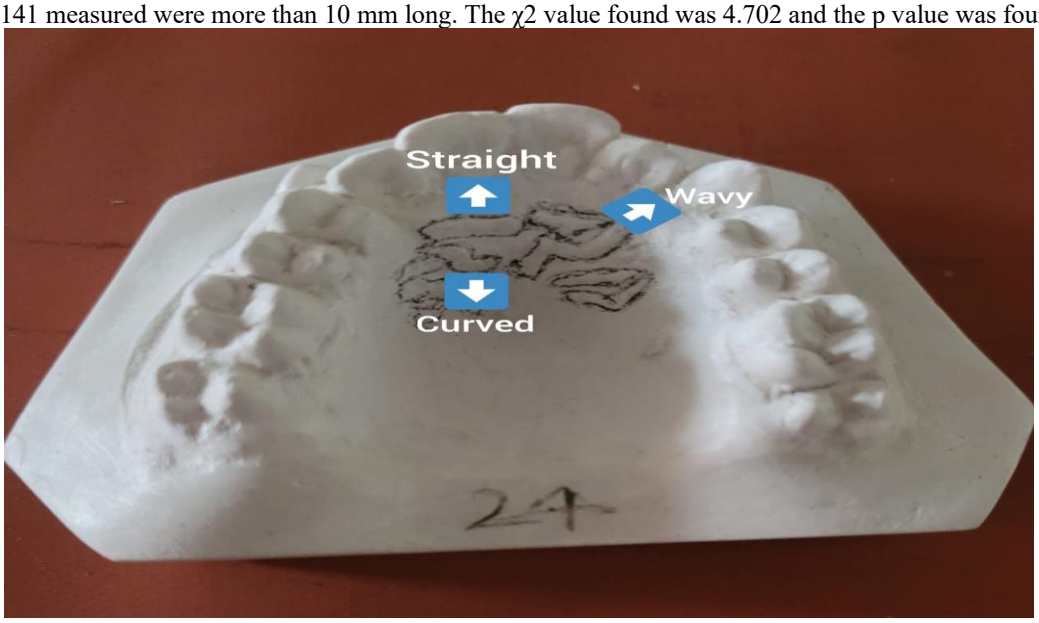

Figure 1: Maxillary cast showing Rugae Pattern as marked with black ink

Table 1: Total Number of subjects and the mean value of rugae in males and females

	Male	Female
Total number of subjects	30	30
Total number of rugae	284	226
Mean	9.4	7.5
p-value	0.436	

Table 2: Descriptive Statistics of different types of Rugae categorized by sex

Type of Rugae	Sex	Number
Wavy	M	101
	F	99
Curve	M	123
	F	97
Straight	M	47
	F	21
Circular	M	13
	F	4

Table 3 : Distribution of the different types of Rugae length in males and females

SEX	5mm-10mm	More than 10mm	Total
Male	152	137	284
Female	122	104	226
Total	274	141	510
χ^2 -value	4.702		
p value	1.0		

III. DISCUSSION

Rugoscopy or Palatoscopy is a potent alternative method of identification of the dead. In addition to the conventional methods of forensic interventions, Palatoscopy can be effectively used, provided there are enough antemortem dental records available. This also presents with the limitation of using Palatoscopy as the main method of forensic identification. The method is not only taxing and time consuming but also requires definite dental records, the information of which can only then be matched precisely. In a country like India, it is therefore difficult to ascertain a corpse' identification by mere usage and analysis of Rugae pattern. However, some investigators have assessed the feasibility of the study of Rugae pattern with the aid of a computer and a software program. [4] 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.[4]Thomas et al. have worked on the possible use of palatal rugae patterns in paternity determination.[5] This study was performed to establish Rugae Pattern as a tool for gender identification in forensic odontolgy. In our work, Thomaz and Kotz classification was used to examine the rugae patterns. [5] This approach was discovered to be useful, simple, and time-saving. Our investigation revealed that each of the 60 individuals' palatal rugae patterns was unique. Consequently, the rugae patterns are very distinctive.These findings were in agreement with the results obtained in the similar studies conducted earlier by Dhoke and Osato et.al. [6] and various other authors. Though, the rugae pattern is unique to individuals, interpretation of the rugae pattern is subjective.[7] Our Study was able to demonstrate that amongst male population curved rugae pattern was the most predominant while in the female population wavy rugae pattern was more significantly found. Amongst both male and female casts studied, the mean number of rugae pattern was found more in the males as compared to females. According to the study done by Pooja Balgi et.al the average numbers of rugae were same in both males and females which is different than our study. Straight pattern was commonly seen in females than in males. Analysis showed significant difference with parameters like length and shape (straight pattern) in both the males and females. [8]

A study conducted on students of Jammu city showed that number of palatal rugae was more among males, and straight type rugae were most prevalent among both sexes [9], which differ from the present findings.The study done by Ashutosh et. al shows that the predominant shape of rugae was curved in males and females followed by wavy, straight and circular shapes.[10] This is in accordance to the present study.In the past, the shape of rugae was compared by Nayak *et al*. According to their study, the predominant shape of palatal rugae was wavy and curved shape was more common in both genders. [11]

IV. CONCLUSION

Palatal rugae possess unique characteristics as they are absolutely individualistic and therefore, can be used as a personal soft-tissue 'oral' print for identification in forensic cases. [12] The analysis of palatal rugae combined with other methods is an important alternative and complementary technique for human identification, which thereby provides a multitude of aid in forensic odontology and significantly contributes in forensic investigations. [13]Dental records, dactylogram, and comparing deoxyribonucleic acid are the widely used techniques in mass disasters, but these techniques have their own drawbacks and hence cannot be applied always. In such cases, less known techniques like rugoscopy will be helpful.[14]. The study hereby concludes the significance of rugoscopy in the field of forensic odontology as well as gender identification in the population of greater noida.

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