Original Article

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Palatal Rugoscopy for Sex Determination and Establishing Individuality in Lucknow Population

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Abstract

Introduction: Palatal rugoscopy is the name given to this study of palate rugae pattern. Palatal rugae are irregular, asymmetric ridges of mucous membrane extending laterally from the incisive papilla and the anterior part of palatal raphe and it remains unchanged during an individuals' lifetime. Above all it has the potential to remain intact by virtue of their internal position when most other anatomical structures are destroyed and burned. This quality of this structure is considered to be unique and similar to finger prints and are advocated in personal identification. *Aim:* The purpose of this study is to investigate difference in the palatal rugae patterns in males and females and to assess the more common predominant pattern. *Material & Method:* A total of 40 maxillary dental casts obtained from 20 males and 20 females student population of lucknow, were examined for the palatal rugae patterns by applying the classification proposed by Thomas & Kotze. Palatal rugae pattern were examined in both the sexes on right and left sides of the palate for the total number, length, shape, predominant direction and then results were statistically analysed. *Result:* According to the analysis total no of rugae in males higher than females. Statistical analysis showed higher mean value in males. No of primary rugae in females were 136 (71.72%) and in males 134 (69.07%).The incidence of curved rugae was more among the males than females. The incidence of straight rugae was more among the females than the males. The incidence of backwardly directed rugae was more among males compared to females. The incidence of perpendicular rugae was more among males compared to females. The present study showed significant difference in the number of rugae between the genders. *Conclusion:* It has been proved that rugae are unique to an individual and are sufficiently characteristic to distinguish between individuals but rugae pattern are complex and the shortcomings of palatoscopy are that proper identification during postmortem is impossible due to absence of antemortem reports.

Keywords: Palatal Rugoscopy ; Rugae Pattern; Finger Prints; Mucous Membrane; Sex Ditermination.

Introduction

Identification of an individual is a pre-requisite for certification of death and for personal, social and legal reasons. Human identification is a mainstay of civilization, whether in living or dead, and the identification of unknown individual has always been of paramount importance to our society. Human identification is based on scientific principles, mainly involving dental records, fingerprints and DNA comparisons. In forensic odontology dentists play a pivotal role in supporting legal and criminal issues [1]. It refers to the proper handling, examination and evaluation of dental evidence, which will be then presented in the interest of justice. Dental evidence can be used as the sole method of identifying a deceased person. In circumstances where identification of an individual by fingerprint or dental record comparison is difficult, it becomes necessary to apply a lesser known and unusual technique like palatoscopy. Palatal rugae have been shown to be highly individual and consistency in shape throughout life [2]. *Winslow (1732)* seems to have been the first to describe the palatal rugae.

Transverse palatine folds or palatal rugae (PR), are

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asymmetrical and irregular elevations of the mucosa located in the anterior third of the palate which are made from the lateral membrane of the incisive papilla, arranged in transverse direction from palatine raphe (midsagittal plane) [3].

The palatal rugae appear towards the third month of intrauterine life, from the covering connective tissue in the palatine process of maxillary bone, and its development and growth is mutually controlled by epithelial- mesenchymal interactions [2, 4].

The palatal rugae, like fingerprints *(Limson & Julian)*, have significant characteristics features as they are unique patterns in each individual and remain stable from the time of development until death. Once formed, it only changes in its length, due to normal growth, staying in the same position throughout the life of a person. His study on the identification of persons is called palatoscopy or palate rugoscopy (Caldas et al.) [5]. They are protected from trauma and high temperatures because of their internal position in the oral cavity, surrounded and protected by lips, cheeks, tongue, teeth and bone [5, 6]. The use of palatal rugae was suggested as a method of identification first in 1889 by Allen and Muthusubramanian et al., 2005 [7, 4].

This present study is an attempt to identify the patterns of palatal rugae in individuals and to compare the rugae patterns in males and female thereby highlighting the importance of palatal rugae in establishing person's identity.

Material and Method

Materials for the study comprised of 40 subjects, 20 males and 20 females between 15 and 50 years. Subjecs were selected randomly coming to the department of Oral Medicine and Radiology. Subjects without braces, removable partial dentures and fixed partial dentures and subjects without abnormalities of palate and lips like the cleft palate and cleft lip, gag reflex were only included in the study. The various steps were involved in the sample study. After obtaining informed consent, alginate impression of maxillary arch was made and the study models were prepared with type III dental stone for interpretation. The rugae were delineated using a sharp graphite pencil and recorded according to the classification given by *Thomas and Kotze (1983) [2,8].*

The rugae were marked and assessed as followed: [9,10]

1. Total number of rugae
2. Number of primary rugae
3. Predominant Shape
4. Predominant Direction
5. Unification of rugae

The rugae were classified based on their length as:

1. Primary->5mm,
2. Secondary- 3 to 5mm
3. Fragmentary-<3mm

Rugae less than 2 mm were disregarded. A ruga's length was determined by measuring its greatest dimension regardless of its shape.

The rugae were divided into 4 types based on their shape as Fig1:

1. Curved: They had a crescent shape and curved gently.
2. Wavy: If there was a slight curve at the origin or termination of a curved rugae.
3. Straight: They run directly from their origin to termination.
4. Circular: Rugae that form a definite continuous ring were classified as circular.

The direction of the rugae was determined by measuring the angle formed by the line joining its origin and termination and the line perpendicular to the median raphe.

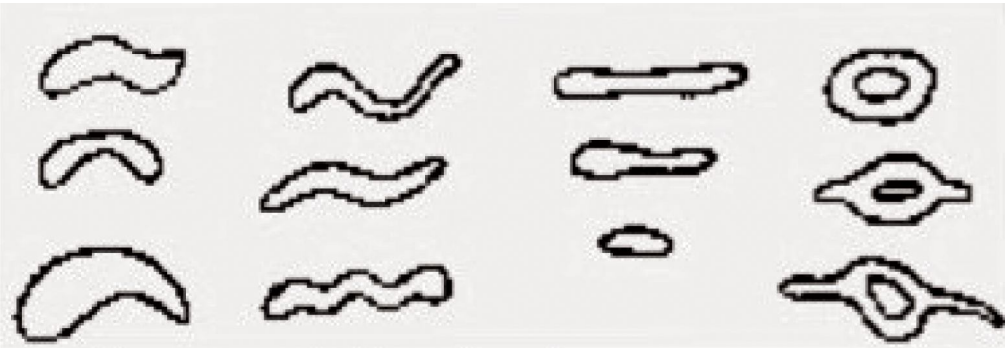

Fig. 1:

Based on the direction rugae were classified as Fig 2:

1. Forwardly directed rugae - associated with positive angles
2. Backwardly directed rugae - associated with negative angles
3. Perpendicular rugae - associated with zero angles.

Unification was said to have occurred when two rugae joined at their origin or termination Fig 3:

1. Diverging- If two rugae had the same origin from the midline but immediately branched.
2. Converging- Rugae with different origins from midline, but which joined on their lateral portions. All the details from each dental cast

Association between rugae forms and gender were tested using student unpaired T test.

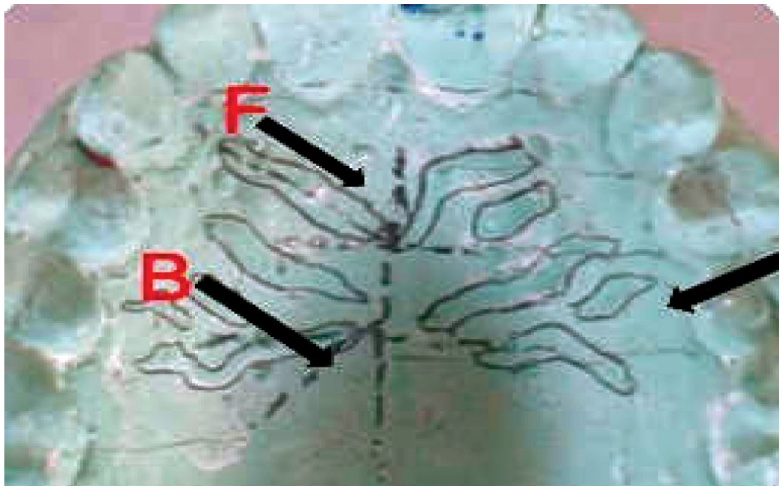

Fig. 2:

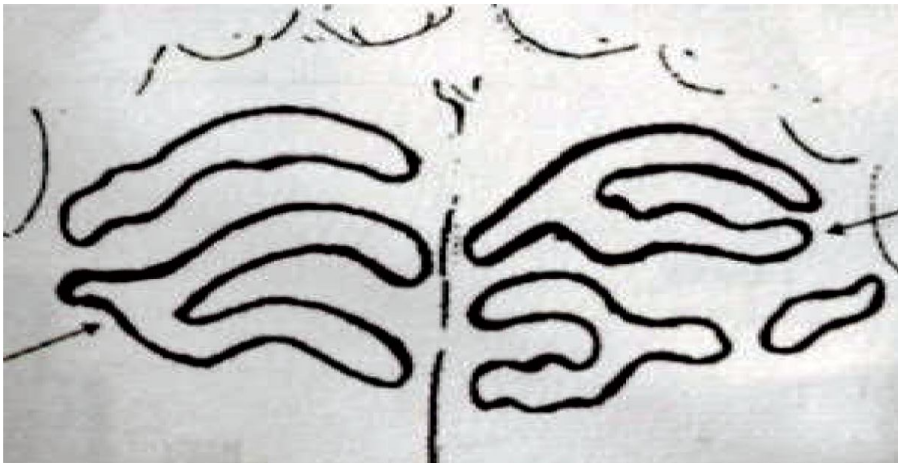

Fig. 3:

Results and Observtion

A total of 40 maxillary dental casts obtained from 20 males and 20 females student population of lucknow, were examined for the palatal rugae patterns by applying the classification proposed by *Thomas & Kotze.*

Total Number and Type of Rugae

According to the analysis total no of rugae in males higher than females. Statistical analysis showed higher mean value in males (Table 1).

No of primary rugae in females were 136 (71.72%) and in males 134 (69.07%) Fig 4, 5:

Table 1

Parameters	Sex	Mean	S.D.
No. of Rugae	Male	9.7	1.92
	Female	9.55	2.24

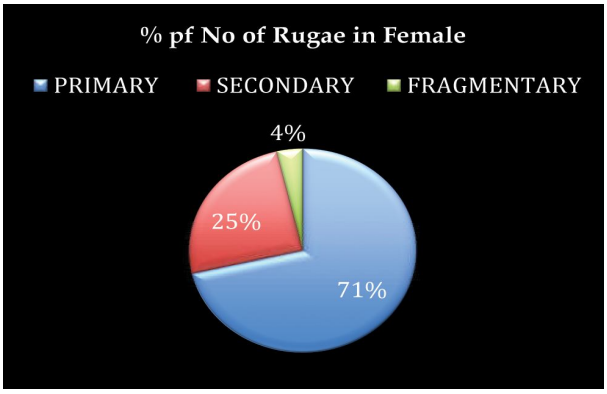

Fig. 4:

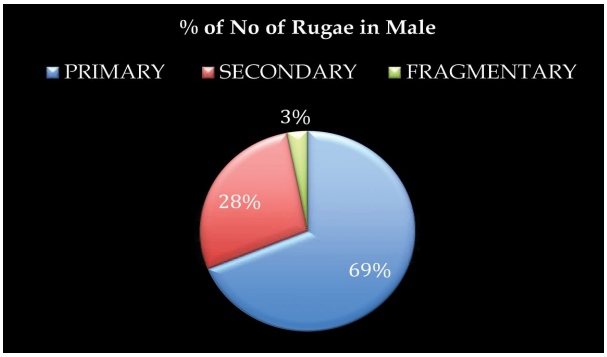

Fig. 5:

The mean value of no of primary rugae are shown in Fig 6:

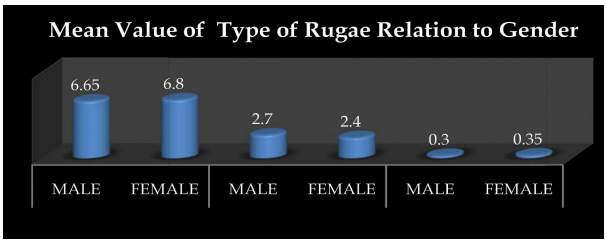

Fig. 6:

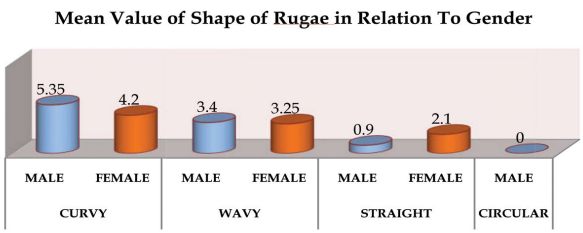

Fig. 7:

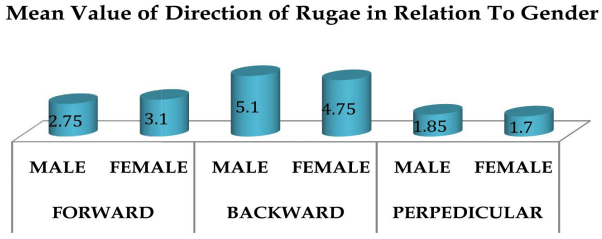

Fig. 8:

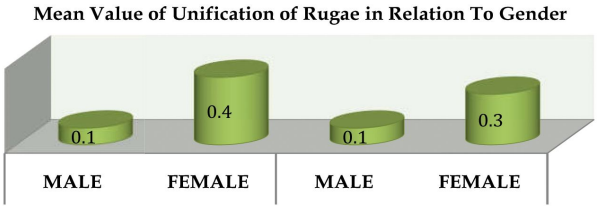

Fig. 9:

Predominant Shape

As shown in Fig 7, The incidence of curved rugae was more among the males than females. The incidence of straight rugae was more among the females than the males.The incidence of wavy rugae was more among the males than the females. No of circular rugae was higher in females than males.

Predominant Direction

As shown in Fig 8, the incidence of forwardly directed rugae was more among females compared to males. The incidence of backwardly directed rugae was more among males compared to females. The incidence of perpendicular rugae was more among males compared to females.

Predominant Unification

As shown in Fig 9, both the diverging and converging rugae pattern was seen in female.

Discussion

The application of palatal rugae pattern for personal identification is suggested by various authors. Palatal rugoscopy was first proposed in 1932, by a Spanish investigator named Trobo Hermosa. A proper classification of palatal rugae was not put forward by Lyselluntil 1955 [11]. Several studies done by such as Carrea (1938), Lysell (1955), Sassouni (1957), and English Wetal (1988) have recognized palatal rugae pattern to be distinct [2,11].

The study of Dohke and Osato (1994) was done to compare the primary and secondary rugae of Japanese population reported that the number of rugae on the right side was comparatively lesser than that on the left side. In contrast, the Nepalese with more secondary and fragmentary rugae had smaller number of left side rugae. Thus it was deducted that secondary and tertiary rugae may have greater discriminatory potential than the primary rugae [2,11,12]. Thomas and Kotze also noted that although primary rugae have been more widely studied than

secondary and tertiary rugae, they do not possess strong discriminatory ability between different human populations [2,8].

The study byKapli et al. 1997 did not reveal any significant differences in the number of primary rugae between aboriginal males and females. Authors who studied pattern in Australian Aborigines and Caucasians, where wavy and curved rugae are most prevalent while straight, circular are less common [2].

But, the present study showed significant difference in the number of rugae between the genders. Our present study showed similar results with higher prevalence of curved & wavy pattern followed by straight.

Faisal M Fahmi et al. (2001) had reported that there was a significant difference in the shape of rugae in males & females in Saudi population. Faisal reported an increased incidence of circular rugae among the females when compared to the males Where as present study also compared the rugae direction which showed higher prevalence for backward & forward direction with no significant sex differences in rugae direction [9,13].

Bakkannavar M Shankar et al. found the incidence of forwardly directed rugae was more among the females whereas the backward and perpendicularly directed rugae were more among the males. These observations were in contrast to the studies conducted by Shwetha et al. Our study has showed similar result to Bakkannavar M Shankar et al.Comparisons of the unification of rugae both converging & diverging did not show any specific trend. This was in contrast with the observations made by Shwetha et al who reported that males had more diverging rugae than females which contradict our study where we had found diverging rugae more predominant in females than males.Faisal observed that the Saudi females had more converging rugae than males [13].

Conclusion

Study was done to look for the variation in the pattern of rugae among the males and females of the Indian (Lucknow) population. The statistical analysis of the data revealed significant differences among the males and females in relation to the various parameters studied. It has been proved that rugae are unique to an individual and are sufficiently characteristic to distinguish between individuals. Rugae pattern are complex and the shortcomings of palatoscopy are that proper identification during postmortem is impossible due to absence of antemortem reports. In addition, intra and interobserver errors are possible to occur in cases of complex rugae patterns. So, a very careful observation is important. It is envisaged that a single operator alone (eliminating inter-observer error), using the given classification, can successfully apply it in a comparative project.

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