Original Research

STUDY OF PATTERN OF THE PALATAL RUGAE IN AURANGABAD REGION IN MAHARASHTRA

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ABSTRACT

The palatal rugae pattern can act as a characteristic in identification of a person. The distinctiveness of rugae to each individual has already been accepted as a potential utility to personal identification. The analysis of palatal rugae combined with other methods like DNA, dactylography, is an significant alternative and complementary technique for human identification, which thereby provides a multitude of aid in forensic odontology and significantly contributes in forensic investigations. This study aims to analyze the various patterns in palatal rugae in Aurangabad region of Maharashtra.

Key Words: Identification, palatal rugae, rugoscopy, pattern.

INTRODUCTION:

Palatal rugae are anatomical wrinkles or folds called ñplica palatine,ò the asymmetrical connective tissue located on the anterior third of the palate behind the incisive papilla. Palatal rugae appear in the

3 rd month of intra-uterine life. Due to its anatomic position, rugae are protected from thermal insults by the tongue and buccal pad of fat.

Forensic odontology involves participation of a dental surgeon in assisting legal and criminal issues.[2] Establishing a person's identity can be a very difficult process in forensic identification. Dental, fingerprint, retina and DNA comparisons are the most common techniques used in this context, allowing fast and secure identification. DNA testing is the gold standard in forensic science but it is very costly and cannot be conducted for everybody. Palatal rugoscopy was first proposed in 1932 by the Spanish investigator Trobo Hermosa. *Palatoscopy*, or *palatal rugoscopy*, is the name given to the study of the palatal rugae in order to establish a person's identity. Palatal rugae have been compared with fingerprints and are unique to an individual They can be of particular significance in edentulous cases and also in certain conditions where there are no fingers to be studied, such as burned bodies or bodies that underwent severe decomposition The uniqueness, postmortem resistance, overall stability, and, in addition, low utilization cost make palatal rugae an ideal forensic identification parameter.

Relevance of Palatal Rugae in Forensic Odontology:

Palatal rugae analysis may serve as an important aid in forensic odontology as they remain consistent in shape, pattern, direction & unification throughout the life of an individual except change in their size with growth of the palate. They are well protected from heat, chemicals & trauma due to their internal position.[3]

In a study conducted by Muthusubramanian et al. it was found that among the subjects with third-degree panfacial burns, 93 percent of the palatine rugae were normal. The authors observed no changes in the color or surface anatomy of the palatine rugae in 77 percent of the human cadavers. They concluded that the palatine rugae could be used as a reference landmark during forensic identification of an individual.[4]

Classification of the palatal rugae:

According to Lysell (1955):Palatal rugae were classified depending on its length.[5]

- Primary: 5mm or more
- Secondary: 3-5mm
- Fragmentary: 2-3mm
- Rugae smaller than 2mm are disregarded.

Da Silva Classification:

Based on shape[6]

Palatal rugae classified into two types-

- Simple: Numbered from 1-6
- Composed: Resulting from combination of 2 or more rugae patterns

Classification Rugae type

Classification	*Rugae type*
1	Line/straight
2	Curve
3	Angle
4	Circular
5	Wavy
6	Point

- Line/Straight: They run directly from their origin to the termination.
- Curve: They had a crescent shape and curved gently.
- Angle: They had angulated appearance
- Circular: Rugae that form a definite continuous ring were classified as circular.
- Wavy: There was a slight curve at the origin or termination of the curved rugae.
- Point: They had an isolated area with no any branching, curving or extension.

Rugae unification pattern classification:

Based on the unification pattern of the rugae are classified as:[7]

- Converging- rugae with different origins from the midline, but which joined on their lateral portions.
- Diverging- if two rugae had the same origin from the midline but immediately branched.

Classification based on orientation of rugae in relation to mid palatal raphe:

- Forward
- Right angle/ perpendicular
- Backward[8]

Analysis of Rugae Pattern by computerized method:

Analysis of the palatal rugae can be carried out by a software ñPalatal Rugae Comparison Software (PRCS Version 2.0).ò by first taking digitized image of palate. Research shows that it is 92-97% accurate[9].

MATERIAL AND METHODS

Forty seven patients (25 males, 22 females) aged 20-70 years were randomly selected from the routine outpatient department at a private clinic in Aurangabad. Maxillary impressions were made using alginate hydrocolloid and cast in dental stone, after informed consent was taken. Palatal rugae pattern were then evaluated under the parameters such as length, number, shape, direction and unification in relation to raphe.

Statistical analysis:-

All data was collected and visually screened for any missing data or outliers. Statistics were performed by tabulating the data using the Microsoft excel 2013 and statistically analyzed using www.openepi.com. Descriptive statistics (mean and standard deviation) were determined for the number of palatal rugae according to length (primary, secondary and fragmentary), shape (line, curve, angulated, circle, wavy, point), direction (forward, backward, perpendicular) and unification in relation to raphe (converging and diverging.)

P value <0.05 was considered to be statistically significant.

RESULTS

In the present study, there was no significant intra-/or inter-observer error. The total no. of rugae of various shapes, length and direction were collectively compared with gender i.e in males it was found (2.67$\pm$3.27) and in females it was (2.85$\pm$3.54). However, the p value was more than 0.05, hence the relation between total no. of rugae with accordance to gender was not significant.

Considering the length pattern of the rugae, primary rugae were the pre-dominant pattern compared to secondary rugae. The most frequent was the wavy shape, followed by line, angle, curve, point and least frequent was circular. Perpendicular/right angled direction in relation to the raphe was comparatively less common than the forward and backward directions. Applying the tests of significance it was found that neither of the rugae characteristics were significant with respect to length, shape or direction.(table no. 2)

Comparing the no. of rugae with respect to rugae shapes in both gender, it was found that wavy pattern was found predominant in both male(39.4%) and female (44.7%). Least common shape was circular which was missing in all males and in females it was 3% which was also the least found shape.(table no. 3)

Table no.1-Total no. of rugae in males and females

Gender	Total Individuals	Total No of Rugae	Mean	SD
MALES	25	188	2.67	3.27
FEMALES	22	200	2.85	3.54

t- value- 1.17196 ; p value- 0.7030

Table no.2 - Descriptive statistics of palatal rugae characteristics

Rugae Characteristics	Type	No of rugae (n=388)	Mean	SD
Length	Primary	335	7.04	2.16
	Secondary	53	1.21	1.88
Shape	Line/straight	87	1.85	1.23
	Curve	54	1.15	1.12
	Angle	64	1.36	1.05
	Circular	3	0.02	0.15
	Wavy	153	3.26	1.71
	Point	27	0.60	0.80
Direction	Forward	145	3.09	1.85
	Backward	147	3.17	2.17
	Right angled/ Perpendicular	96	2.04	1.65

Length :ï t-value:1.3200 ; p value -0.2227 Shape :- t- value- 2.060 ; p value- 0.9406

Direction:- t-value:4.302, p value -0.830

Table No. 3 - Comparative statistics of rugae based on shapes in males and females.

Rugae shapes	***No. of rugae***		
	Total individuals (n=47)	**Males (n=25)**	**Females (n=22)**
Line	87(22.4%)	46(24.5%)	41(20.5%)
Curve	54(13.9%)	24(12.7%)	30(15.0%)
Angle	64(16.5%)	32(17.0%)	32(16.0%)
Circle	3(0.8%)	0(0.0%)	3(1.5%)
Wavy	153(39.4%)	84(44.7%)	69(24.5%)
Point	27(6.95%)	14(7.4%)	13(6.5%)
Total	388	188	200

Table No. 4 - Descriptive statistics of rugae based on unification in males and females.

Characteristics	Type of union	No. of rugae	Males	Females	Mean	SD
Unification (n=65)	Converging	19	9(27.27%)	10(31.25%)	0.40	0.65
	Diverging	46	24(72.72%)	22(68.75%)	0.98	0.82

t-value:1.5914 ; p value -0.2845

In the study diverging pattern of unification was more predominant than the converging form in both gender. However, there were no significant differences between both groups in the incidences of the unification forms and the directions of the palatal rugae (table no. 4)

DISCUSSION

In our study, maxillary impressions made using alginate hydrocolloid and cast in dental stone models were used for the analysis due to easiness and minimum fabrication cost. Apart from Da silva classification used for the study, the other classification device to record the rugae pattern is Lysell.[10] The present study investigated differences in the number, shape, direction and unification of rugae pattern in 25 males and 22 females visiting a routine outpatient department in a private dental clinic.

The total no. of rugae of various shapes, length and direction were collectively compared in both gender. It was found that there was no significance in the no. of total rugae of various shapes, patterns in males and females. Hence the relation between the no. of rugae and gender couldn't be established. Similar type of observation was found in the study conducted by Shetty M, et al.[11] Also the more no. of rugae in females as compared to males was consistent with study by Babu G.S., et al.[12]

In our study, it was found that the primary rugae outnumbered the secondary rugae, both in males and females. However, no significant difference was found in the no. of primary or secondary rugae with respect to gender. This observation was consistent with the observations in the study conducted by Shetty M, et al[11] and Babu G.S., et al.,[12] According to Balgi P et al,[1] the no. of rugae in females were less as compared to males which was contrary to our study.

During the study, the wavy pattern was found to be predominant over the other shapes i.e 39.4 %.. It was found that wavy pattern outnumbered the other pattern in both males and females. This observation was consistent with the study conducted by Azab S, et al[15] and Paliwal A, et al.[13] The predominant shape of the rugae were curved and straight shaped rugae among females and wavy in males in the study conducted by Shetty M, et al.[11] According to the study Balgi P et al[1] the straight pattern was found to be the most common. The circular rugae was found to be the least common (3) in females while it was missing in the males(0). This finding of dominance of circular rugae was consistent with the study conducted by Fahmi, et al.[14]

The incidence of forwardly directed and backwardly directed rugae was more than the perpendicularly directed rugae. These observations were in contrast to the study conducted by Shetty M, et al.[11] There was no significant difference in males and females with respect to the no. of rugae in the three directions. This was again contrary to the findings observed by Shetty M, et al[11] where forwardly directed rugae was more in females, backwardly directed and perpendicularly directed rugae were more in males. In the study conducted by Azab S, et al[15] found that, forward direction was the predominant direction of palatal rugae.

We observed that there was more diverging pattern in the rugae than the converging pattern, both in the males and females. There was no any significance in the unification patter with respect to gender. Comparisons of the unification of rugae both converging & diverging did not show any specific trend in the study conducted by Shetty M, et al.[11] This was contrary to the study conducted by the by Azab S et al[15] found that, converging pattern was more common that too with predominance in females.

CONCLUSION

After observing the results while analyzing the length, shape, direction and unification pattern, it was found that there is no any significant trend to distinguish the gender, except for the circular pattern which found only in females. After comparing this study which consisted with the Indian population, with various studies from other ethnic origin, it was found that there are various trends in relation to the shape, direction and unification pattern of the rugae.

Though there is variations in the findings of different individuals rugae pattern, associations between various patterns couldn't be established which itself consolidates the uniqueness of the rugae pattern in every individual.

Due to limited sample size, more research is indicated with the aim to corroborate with the findings from various studies on large sample size including comparison between various populations from different race, ethnic origin. This would essentially signify the genetic base of formation of various patterns of palatal rugae.

Conflict of interest: None

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