ASSESSMENT OF PALATAL RUGAE MORPHOLOGY FOR GENDER IDENTIFICATION

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ASSESSMENT OF PALATAL RUGAE MORPHOLOGY FOR GENDER IDENTIFICATION

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ABSTRACT:

BACKGROUND

In forensic odontology, individual's identity is a difficult task. In circumstances where recognizable proof of person by fingerprinting or dental record is troublesome, palatal rugae may considered as an elective source. It has been appeared to be profoundly individualistic and it keeps up consistency in shape throughout the life. Therefore, this study aimed to assess the significance of palatal rugae in gender identification.

METHODOLOGY

A crossectional study was conducted in Dental opd of KMDC and Ziauddin University hospital. A total of 100 casts were evaluated and palatal rugae were examined and recorded according to the classification given by Thomas and Kapali et al. Participants with any congenital abnormality, inflammation, trauma and patient undergoing orthodontic treatment were excluded from the study.

RESULT

Significant difference was found in the distribution pattern of straight, curved and wavy whereas male has higher incidence of rugae pattern altogether. Moreover, the side distribution of palatal rugae length and unification patterns showed significance.

CONCLUSION

In conclusion, palatal rugae are specific for the male and female population, and has a possible role in identifying gender. Further studies in various populations and in different ethnic groups are required to explore the potential of palatal rugae patterns in forensic dentistry.

KEY WORDS:

Palatal rugae, Forensic identification, Forensic odontology

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INTRODUCTION:

Establishing an individual's identity in accidents or in massive disaster is the most challenging process in forensic sciences. (Standring 2016) It has a major part socially as well as legally regarding the rights of the deceased person and their families.(MOYA PUEYO, SANCHEZ SANCHEZ et al. 1994) Visual identification, fingerprints, DNA comparisons and dental records are the most common methods used for forensic identification. However, these methods have some limitations associated with changes in postmortem occurring with time, temperature and humidity. DNA profiling is accurate but it is time consuming and expensive method. Dental identification is regarded as an alternative comparative method for identification. Palatal rugae or pliace platinus are a series of conserved transverse ridges located on the anterior aspect of hard palate extending laterally from the incisive papilla contributing to a unique pattern.(Standring 2016)This pattern demonstrate uniqueness for every individual and stability .The importance of palatal rugae in forensic identification has great significance due to their morphological stability during life. Moreover, their number remains same throughout the childhood and adolescence as well as they are not altered by heat, chemical and trauma.(Azab, Magdy et al. 2016, Gupta, Kheur et al. 2022) In addition to it, it shows a significant association between shapes and ethnicity.(Gupta, Kheur et al. 2022)

Allen in 1889 suggested the application of palatal rugae in forensic identification.(MOYA PUEYO, SANCHEZ SANCHEZ et al. 1994)Thomas et al, and Kapali et al, proposed the classification of palatal rugae that includes number, length, shape and their patterns. According to the length it is categorized as,

Primary rugae (5-10 mm), Secondary rugae (3-5 mm) and Fragmentary rugae (less than 3 mm).

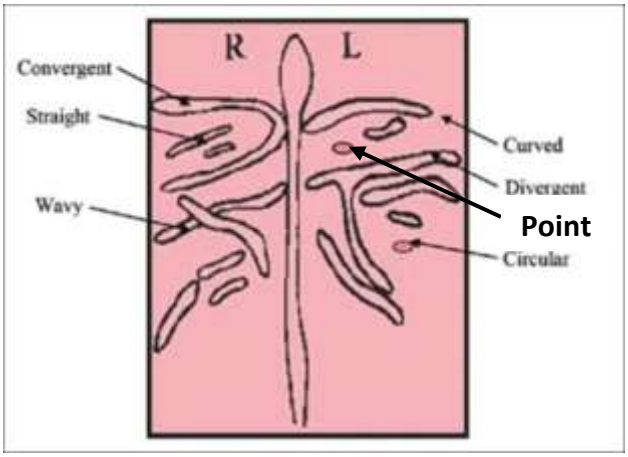
Whereas on the basis of shapes they are divided as,

Straight – Runs straight from start to end

Curvy – crescent shaped,

Circular –continuous ring formation,

Wavy – Serpentile form.



Thomas classification (Thomas, Kotze et al. 1987)

These patterns are further categorized into diverging and converging types. The divergence pattern occurs when two rugae originate from the same origin but diverge laterally. Convergence patterns, on the other hand, occur when two rugae originate from different regions and converge laterally.(Smriti, Gupta et al. 2021) Palatal rugae can be an essential aid in diagnosing and planning orthodontic treatments. Besides they show a significant association between shapes and ethnicity. These patterns might be specific to racial groups. Besides having uniqueness to individuals, they have shown no apparent effects on rugae after surgical extractions and orthodontic treatments permitting them to be used as stable reference points in analysis and identification.(Khanagar, Vishwanathaiah et al. 2021)

Considerable amount of literature is present on genetic predisposition, prevalence and morphological patterns.(Kaul, Vaid et al. 2021, Khanagar, Vishwanathaiah et al. 2021, Putrino, Raso et al. 2021) To date, there is scarce literature present on whether sex can be predicted through palatal rugae patterns.

Therefore, we aimed to analyze the palatal rugae patterns to assess its significance in gender identification.

METHODOLOGY

This crossectional study was conducted in Dental opd of KMDC and Ziauddin University hospital, Karachi. The study sample consisted of casts obtained from 100 subjects coming to Dental opd of both KMDC and Ziauddin university hospital. Out of the total 100 samples ,50 were men and 50 were females. All the participants belong to the age group in between 21-60 years were included, whereas participants with any congenital abnormality, inflammation, trauma and patient undergoing orthodontic treatment were excluded.

A written informed consent was attained from each subject before taking the impression. Each participant was examined clinically and appropriate impression tray was selected and impression was taken with irreversible hydrocolloid impression material (alginate).After the impression it was poured by dental stone and a plaster cast was obtained. Under adequate light and hand lens

magnification, rugae patterns were carefully examined and delineated by pencil on study casts, according to the Thomas and Kapali et al classification.

STATISTICAL ANALYSIS:

The data was analyzed by using SPSS version 23. The rugae were counted in numbers and are represented in mean anad standard deviation the differences in number of both genders and sides were analyzed by applying independent sample t test at 95% confidence interval and 5% margin of error.

RESULTS:

DISTRIBUTION OF RUGAE PATTERN

A total of 100 casts were evaluated showed significant distribution pattern of rugae in both genders as shown in Table1.The distribution pattern of straight, curved and wavy showed significant difference in both gender whereas male has higher incidence of rugae pattern altogether specifically in straight, circular and in wavy.

Table 1

SHAPE	MALE	FEMALE	P-VALUE
STRAIGHT	37	6	0.001
CURVED	24	29	0.001
CIRCULAR	94	97	0.249
ANGULAR	93	94	0.5
WAVY	11	3	0.035
POINT	98	100	0.249

p-value of less than 0.05 considered statistically significant

Table 2. showed shape distribution pattern in left and right rugae with higher incidence of rugae shown on left side specifically in curved, wavy and point while on right side straight and angular pattern are more common. This table indicated significant difference in straight, curved and wavy (p-value 0.001)

Table 2

SHAPE	LEFT	RIGHT	P-VALUE
STRAIGHT	5	38	0.001
CURVED	42	11	0.001
CIRCULAR	95	96	0.5
ANGULAR	92	95	0.284

WAVY	14	0	0.001
POINT	100	98	0.249

p-value of less than 0.05 considered statistically significant

DISTRIBUTION OF UNIFICATION PATTERN:

Table 3 indicated unification palatal rugae pattern, out of which male and female rugae patterns showed no significant difference. As far as side is concerned, left side showed higher rugae patterns as compared to right side whereas convergent and divergent patterns showed significant differences.

Table 3

	Left	right	p-value	male	female	p-value2
convergent	79	59	0.002	71	67	0.372
divergent	**92**	**83**	0.049	92	83	0.5
Unspecified	71	79	0.126	78	72	0.207

p-value of less than 0.05 considered statistically significant

GENDER DISTRIBUTION OF RUGAE LENGTH

Table 4 shows palatal rugae length in both male and female subjects, indicated signification distribution of primary rugae length when comparing left and right side whereas in gender only fragmented rugae length showed significant difference.

Table 4

	Left	Right	P-value	Male	Female	P-value2
Primary	15	15	0.004	15	15	0.719
Secondary	5	6	0.627	3	8	0.023
Fragmented	48	50	0.444	48	50	0.04

DISCUSSION:

Many efforts have been made for accurate human identification that may avoid the chances of errors. Palatal rugae being the most stable anatomical landmark in the oral cavity considered as one of the reliable method for identification.(Putrino, Raso et al. 2021) Flaws has been reported in identification by fingerprinting and DNA in some forensic circumstances. Palatal rugae patterns prove as useful adjunct in these situation for forensic identification.(Gaikwad, Kamble et al. 2019)In accordance with previous studies, this study focuses on the advantage of palatoscopy in forensic identification.

This study showed higher number of rugae in males as compared to females. Magdy et al reported that different ethnic races and sex affect the frequency of palatal rugae number.(Azab, Magdy et al. 2016) Our literature supports the results of previous studies.(Sherif, Hashim et al. 2018, Jayakrishnan, Reddy et al. 2021, Putrino, Raso et al. 2021) and reported that the frequency of

straight, curved and wavy are significantly higher in males than in females. However only the frequency of circular rugae in our study was higher in females but doesn't show any significance. Similarly , studies reported curved and wavy pattern to be the most common pattern in both genders.(Caldas, Magalhaes et al. 2007, Byatnal, Byatnal et al. 2014) Whereas earlier studies showed significantly higher frequency of circular rugae in females.(Smriti, Gupta et al. 2021, Gupta, Kheur et al. 2022) Moreover, few studies reported that straight pattern was predominant in females.(Pereira, Shetty et al. 2018, Matsuda, Yoshida et al. 2020)

We observed curved and wavy patterns were significantly higher on left side than on right side. furthermore, convergent and divergent rugae pattern was significantly higher on left. However, no significance found in our study in unification patterns on gender basis which was supported by earlier studies.(Gupta, Kaur et al. 2021, Smriti, Gupta et al. 2021) Whereas a Previous study reported predominant diverging pattern in females and converging pattern in males.(Smriti, Gupta et al. 2021)

On the basis of rugae length, our study assessed the odds of predicting gender using palatal rugae patterns and observed fragmented rugae as the most prominent rugae in male and female population, whereas a study reported primary rugae to be more prominent in both genders.(Nagare, Chaudhari et al. 2018) On contrary our study showed significance in secondary and fragmented rugae pattern.

Besides determining the palatal rugae distribution pattern in gender, we assessed the role of palatal rugae in terms of age and found that palatal rugae are higher in age group between 30 to 40 years. On contrary, Lysell et al proposed that with increasing age frequency of palatal rugae decreases but their characteristic pattern does not change with time.(Salzman 1955) Moreover few researchers stated about the stability of palatal rugae that they remained as it is throughout the life.(Chong, Mohamed et al. 2020)

The current study supported the fact that palatal rugae are sufficiently characteristic to demonstrate the person's identity through discrimination and may aid in the identification purpose. However, this study suffers some limitation due to its sample size and its confined to the population of Karachi.

CONCLUSION:

Our study suggests that palatal rugae is the stable anatomical landmark and can aid in the forensic identification for postmortem resistance and stability. Moreover, they are specific for the male and female, and hence can have a possible role in identifying gender. However, additional studies in various populations and in different ethnic groups are required to explore the potential of palatal rugae patterns in forensic dentistry.

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