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ORIGINAL ARTICLE

Rugoscopy as an adjunct to sex differentiation in Forensic Odontology

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ABSTRACT

Palatal rugae are anatomical wrinkles or folds called "plica palatine," the asymmetrical connective tissue located on the anterior third of the palate behind the incisive papilla. Palatal rugae are important tool for the identification of individual because of its unique pattern. This study aimed at comparing the rugae patterns among males and females as an adjunct to gender differentiation.

Aim and Objectives:-The aim of this study was to compare the rugae pattern among males and females. Objectives were to evaluate and compare total number, length, shape, and unification of rugae among males and females.

Material and method:- Eighty (40 males and 40 females) maxillary casts were poured with dental stone. The method of rugae identification was based on the classification of Thomas et al and kapali et al. This classification includes number, length, shape and unification of rugae.

Result:- After analyzing all the data, we observed significant higher number of wavy and curved rugae patterns among females then in males.

Conclusion:- We concluded that significant differences occur in the palatal rugae patterns among both the genders.

INTRODUCTION:

Human identification has importance in both aspects of human relationships of social and legal levels. It allows people to preserve their rights and have their duties insist from both public and legal point of view. Identification corresponds to a combination of different procedures to individualize a person or an object.[1]

The identification requires demonstrating that a person or one of his or her characteristics being examined is the same as observed in a previous situation.[2] The difference between recognition and identification is an important aspect.[3] Subjective identification may be considered as experiential without scientific accuracy.

Forensic Odontology is the forensic science that is concerned with dental evidence. The use of teeth as evidence is not recent. There are historical reports of identification by recognizing specific dental features as early as 49 A.C. However, Forensic Odontology, as a science, did not appear before 1897 when Dr. Oscar Amoedo wrote his doctoral thesis entitled "L'Art Dentaire en Medecine Legale" describing the utility of dentistry in forensic medicine with particular emphasis on identification.[4]

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Palatal rugae also called as- plica palatinae or "rugae palatine are the anatomical folds or wrinkles; the irregular fibrous connective tissues located on the anterior third of the palate.[5] Common features are that these are highly individual, consistent in position and shape throughout the life. The anatomical position of rugae (surrounded by: cheeks, lips, buccal pad fat, tongue) provides some protection in case of trauma or incineration.[6] Functions of rugae are that these facilitates food transport through the oral cavity, prevents loss of food from the mouth, participates in food crushing, contributes to the taste perception (has gustatory receptors).

Several classification systems have been given but, most commonly used classification are: (a) according to length (Thomas CJ, Kotze TJW (1983)[7] as- Primary Rugae: (A- 5 to 10 mm; B- 10 mm or more), Secondary Rugae: 3-5 mm, Fragmentary Rugae: less than 3 mm (b) Classification according to unification (by Kapali et al -1997)[8] as Converging, Diverging. (c) Classification according to shape (Kapali et al -1997) as Curved, Wavy, Straight, and Circular. This study aimed at comparing the rugae patterns among males and females as an adjunct to gender differentiation.

MATERIALS AND METHODS:

Aim and objectives:

The aim of this study was to compare the rugae patterns among males and females. Objectives of the study were to evaluate and compare total number, length, shape, and unification of rugae patterns among males and females.

Source of Data Collection:

Total of 80 samples of which 40 males and 40 females with age range between 25-40 years were selected for the study. The subjects were totally healthy, free of congenital abnormalities, inflammation, trauma or orthodontic treatment.

Materials used:

Alginate, type III dental stone, Rubber bowl, Spatula, Perforated stainless steel stock trays (Size- U-1 to U-4), Marking pen, Ruler, Brass wire.

Method of impression making:

Impressions of maxillary arch were made with help of perforated stainless steel stock tray according patient's jaw size using alginate. After obtaining the impression, casts were then poured with dental stone. Casts which were free from voids and bubbles were selected.

Method for identification:

Rugae were highlighted with black marker as Curved, wavy, straight or circular. Rugae length were measured with the help of brass wire and scale.[6]This method of rugae identification was based on the classification system given by Thomas et al (1983)[7] and kapali et al (1997)[8] which includes number, length, shape and unification of rugae.

OBSERVATIONS AND RESULTS:

The total number of rugae and the mean value for males and females is illustrated in Table I. The distribution of different types of rugae, as well as the descriptive statistical analysis are shown in Table 2. There was a significant difference in wavy (0.0001) type which was higher in females than in males (P = .02). Also a significant difference in curved (0.0007) type of rugae were observed which was higher in females than in males. The total number and difference in length of rugae patterns are shown in Tables 3 and 4. The chi-square and t tests showed no significant difference between the two sex groups.

DISCUSSION:

Rugae patterns have been studied for various purposes, including anthropology, genetics, forensic odontology, Prosthodontics, and orthodontics.[9,10] The anatomical position of the palatal rugae inside the oral cavity, provide some degree of protection to rugae patterns in case of fire and high impact trauma.[11] Rugae are among the best protected, morphologically individualizing soft tissue structures in the body, which are preserved even after death and also accessible during life.[11] So, these can aid in human identification in forensics. A study was conducted to evaluate the difference in the characteristics of rugae patterns among males and females.

In presenting study, we found significant differences in the number of rugae among males and females. Females have shown fewer numbers of rugae as compare to males. Dohke and Osato[12] also found similar results among the Japanese. But our study did not confirm the studies conducted by Kapali et al.[8] and Saraf et al.[6] They found no significant difference in the number of rugae among males and females.

Significant differences were also observed in the shape (wavy and curved) of rugae patterns among males and females. But no differences were observed in the straight type rugae among males and females , which is similar to a study conducted by Saraf et al.[6] In his study, he also found

significant differences in circular, converging and diverging type of rugae pattern but, in our study, we did not found any significant difference in the circular, convergence and divergence rugae pattern among males and females.

In presenting study we found statistically significant differences in rugae length of <3mm and rugae with length 5 to 10 mm among males and females which is not supported by any study reported in the literature. A study conducted by Fahmi et al.[11] shows that there is no significant difference in fragmented rugae and those with length 5 to 10 mm among males and females.

In presenting study we also found no difference in rugae length of more than 10 mm among males and females, which is supported by Fahmi et al.[11]

CONCLUSION:

Within the limitations of this study, we concluded that significant differences occur in the palatal rugae patterns among males and females. Although our study demonstrates significant differences in rugae patterns among both the genders, further research may be indicated with a larger sample size and with a wider age range in order to substantiate the findings of the present study. In addition, examining the rugae patterns, including the primary, secondary and fragmentary rugae in other populations may further corroborate the findings.

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TABLES AND FIGURES

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

Gender	Total number of subjects	Total number of rugae	Mean	SD
Male	40	268	3.35	0.57
Female	40	234	2.92	0.54
z-value	4.68			
p-value	0.0001 significant			

Table 2: Descriptive statistics of % of different types of rugae categorized by gender.

Shape	Gender	No.	Mean ± SD	p-value
Divergent	Male	40	4 ± 1.31	0.09 Not Significant
	Female	40	4.76 ± 1.64	
Convergent	Male	40	3.26 ± 0.56	0.07 Not Significant
	Female	40	2.5 ± 0.7	
Wavy	Male	40	3.33 ± 1.32	0.0001 Significant
	Female	40	6.65 ± 1.21	
Curved	Male	40	4.85 ± 1.16	0.0007 Significant
	Female	40	5.27 ± 1.10	
Straight	Male	40	2.2 ± 0.68	0.15 Not Significant
	Female	40	1.83 ± 0.4	
Circular	Male	40	1	Not Applicable
	Female	40	1	

Table 3: Distribution of the length of rugae in the males and females.

Gender	Fragmented less than 3 mm	From 5 to 10 mm	More than 10 mm	Total
Male	42	163	102	307
Female	56	140	94	290
Total	98	303	196	597

$X^2 = 3.591$, Degrees of Freedom = 2, p-value = 0.16

Table 4: Descriptive statistics of difference in the rugae length in mm between the males and females.

Type of Rugae	Sex	Mean ± SD	p-value
Fragmented less than 3 mm	Male	1.05 ± 0.64	0.01
	Female	1.4 ± 0.67	Significant
From 5 to 10 mm	Male	4.07 ± 0.73	0.002
	Female	3.5 ± 0.88	Significant
More than 10 mm	Male	2.55 ± 0.71	0.17
	Female	2.35 ± 0.58	Not Significant

Figures