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RESEARCH ARTICLE

MORPHOLOGICAL ANALYSIS OF PALATAL RUGAE PATTERNS IN KONKAN SAMPLEPOPULATION: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Palatal rugae are irregular and non-identical mucosal elevations seen onthe anterior third of palate. They are arranged in transverse direction on either side of the median palatine raphe and are protected from high temperature and traumabecause of their rational position in the oral cavity. Their number and patterns are not uniform in all the individuals, and they appear to vary in different population subsets.
Aim: The aim of this study was to evaluate thequantitative and qualitative parameters of palatal rugae using studymodels of Konkan samples.
Objectives: To analyze andcorrelate the qualitative characters such as Number, size and shape inmale and female study samples.
Materials and Methods: One hundred dental stone casts of patients with an age range of 17–25 years were selected.The outlines of the rugae were traced using microtip graphite pencil and examined usingmagnifying glass for different patterns. The quantity and quality of rugae patterns wererecorded according to Thomas *et al*. classification and the data were statistically analyzedby the statistician using SPSS program.
Results: The mean rugae count was higher in males (9.90) than in females (9.86).The number of primary rugae count was more in both the sexes.Primary and secondary Rugae was higher among females than males while mean fragmented Rugae was higher among males (0.66) than females (0.58). Curvy, Straightand circular Rugae were higher among females than males while mean Wavy Rugae was higher among males (4.08) than females (3.36).
Conclusion: There is no gender discrimination in relation to palatal rugae in the present study samples. No two study casts showed similarity in the distribution of palatal rugae patterns. The curvy and wavy rugae distributions were predominant in Konkan population.

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INTRODUCTION

According to glossary of Prosthodontic terms, palatal rugae are anatomical folds or wrinkles, the irregular fibrous connective tissues situated on the anterior third of the palate. It is also known as "plica palatinae" or "rugaepalatine". As the name suggests study of palatal rugae is known as palatoscopy or palatal rugoscopy (Kesri*et al*., 2014). Applications of palatoscopy has been found in various field like anthropology, comparative anatomy, forensic odontology,genetics, prosthodontics and orthodontics (Rajguru*et al*., 2014).Pattern of palatal rugae are unique to each and every individual and does not change during the lifetime once they are completely formed. The only change seen is in there length which stops at puberty. Rugae pattern are specific to every racial group assisting the identification of various races (Subramanian*et al*., 2015).Palatal rugae are well protected from high temperature, trauma, post mortem insults and to some extent decomposition due to its internal position and presence of lips, cheeks, tongue, buccal pad of fat, teeth (Byatnal*et al*., 2014).Palatal rugae makes one of the best forensic identification tool due to its stability, uniqueness, post mortem resistance, inalterability, variability and as they are possible to classify (Subramanian and Jagannathan, 2015; Gonçalves*et al*., 2015).Palatoscopy can be used a necro identification technique,palatal rugae patterns can be used in conditions where it is impossible to record fingerprints or lip prints such as decomposed bodies, burnt bodies. It is of great importance in identifying pilots in aeronautical accidents with the help of antemortem data (Nagalaxmi*et al*., 2014).According to literature search (PUBMED, GOOGLE SCHOLAR, EBSCO) none of study has been done on palatal rugae pattern evaluation in konkan

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population. Thus, the objective of the present studywas to record the distribution of the predominant rugaelengthandshapein konkan population and to compare thedistribution of these parameters between males and femalesto know if gender differentiation is possible.

MATERIALS AND METHODS

The study sample consisted of 100 students (n = 100)studying in Yogita Dental college & hospital, khed, Ratnagiri district withinthe age group of 17-25 years, of which fifty were femalesand fifty were males. All of them belonged to the samegeographical population, Konkanregion and were healthy, free ofcongenital abnormalities, inflammation,trauma, orthodontic treatment or any other palatal pathology.Maxillary impression were taken with irreversible hydrocolloid impression material and study models were prepared by pouring dentalstone in the impressions Each cast was numbered for easy identification.The rugae was properly delineated using lead pencil. Later measurement of rugae was done using plastic ruler (Kenson)in mm.The parameters assessed were number, size and shape of palatal rugae. The classification used for rugae size & shape was given by Thomas and Kotze (Shetty *et al*., 2011). They were classified according to length as Primary (>5mm), Secondary (3 to 5 mm) & Fragmentary(< 3mm), andfurther classified according to shape as curved, wavy,straight & circular (Figure 1). All the parameters were analyzed by twoindependent observers. The data thus obtained was recorded & entered into excel sheets & further statistical analysis was done using SPSS (Social Package of Statistical Science) software.Unpairedt-test was utilized to compare the meanvalues of two samples, and Chi-square test was done toanalyze the significant difference between two groups of data.

RESULTS

On applying unpaired t-test. There was no significant difference($p \geq 0.05$) in total number of Rugae among males and females. Mean Total Rugae was higher among males (9.90±1.88) than females (9.86±1.60) (Table 1).On applying unpaired t-test. There was no significant difference($p \geq 0.05$) between different Lengths ofRugae among males and females. Mean Primary and secondary Rugae was higher among females (7.64±1.83)(1.64±0.92) than males (7.62±1.58)(1.62±1.12) while mean fragmentary Rugae was higher among males (0.66±1.15) than females (0.58±0.75) (Table 2).

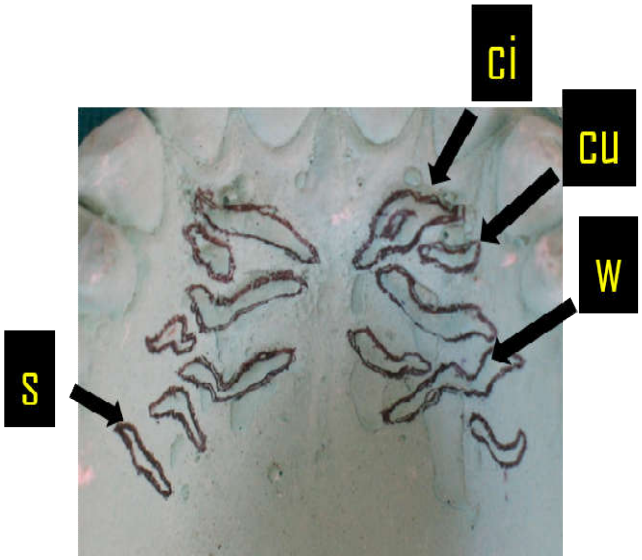

Figure 1. Palatal rugae shape delineation (Cu=curved, Ci=circular, W=wavy & S=straight)

Table 1. Rugae numberbetween males & females in konkan population

Gender	Number	Mean total rugae	Standard deviation	Standard error mean
Male	50	9.90	1.88	0.27
Female	50	9.86	1.60	0.23
P-value			0.17	

p≤0.05= significant (0.17=non-significant)

Table 2. Rugaelength between males & females in konkan population

Gender		Lenghts of rugae		
		Primary	Secondary	Fragmentary
Male	MEAN	7.62	1.62	0.66
	SD	1.58	1.12	1.15
	SE	0.22	0.15	0.16
Female	MEAN	7.64	1.64	0.58
	SD	1.83	0.92	0.75
	SE	0.26	0.13	0.10
P-value		0.55	0.16	0.11

p≤0.05= Significant (0.55, 0.16, 0.11 =non-significant), SD=standard deviation, SE=standard error,

Table 3. Rugae shape between males & females in konkan population

Gender		Shapes of rugae			
		Curved	Straight	Wavy	Circular
Male	MEAN	4.06	1.76	4.08	0.00
	SD	1.85	1.39	1.66	0.00
	SE	0.26	0.19	0.23	0.00
Female	MEAN	4.50	1.98	3.36	0.02
	SD	1.98	1.34	1.43	0.14
	SE	0.28	0.19	0.20	0.02
P-value		0.45	0.43	0.49	0.04*

P=0.04*, Significant (0.45, 0.43, 0.49=non-significant), SD=standard deviation, SE=standard error,

On observation of rugae shapes,the unpaired t-test revealed no statistical significant ($p \geq 0.05$) difference between means of curved, straight and Wavy shapes ofRugae among males and females, while significant difference ($p < 0.04$) was seen between mean circular Rugae among males and females. Mean Curved, Straight and circular Rugae were higher among females (curved=7.64±1.83, straight=7.64±1.83 & circular=7.64±1.83) than males (curved=7.64±1.83, straight=7.64±1.83 & circular=7.64±1.83) while mean Wavy Rugae was higher among males (4.08±1.66) than females (3.36±1.43) (Table 3).

DISCUSSION

Palatal rugae also known as rugae palatina or plicae palatinae transversae are ridges on the anterior part of the palatal mucosa on each side of median palatal raphe and behind the incisive papilla. Significant difference in total number of rugae among males and females was seen in the present study.In our study number of rugae was higher among males than females9.90±1.88 with $P \geq 0.001$ which was non-significant, similar results was also found withHermosilla *et al*. (2009); whereas Verma *et al*. (2014), and Manjunath *et al*. (2012), found that there was more rugae in females.In one of the study bySaraf *et al*. (2011), foundthat males and females has almost same number of rugae.Our study showed no significant difference in length of rugae in both males and females. Although primary and secondary rugae was more in females and fragmentary rugae was more in males0.66±1.15. Fragmentary constituted a very small portion of rugae pattern these results are similar to those of Indira *et al*.Ourresults are inconsistent with previous reports (Saraf*et al*., 2011; Surekha*et al*., 2012; Kapali*et al*., 1997; Paliwal*et al*., 2010).In the present study curved and wavy rugae pattern was predominant in both the genders followed by curved and straight.Wavy pattern was more in males were as curved pattern was more in females. Stastically significant difference ($p \leq 0.05$) was found in circular rugae pattern when compared was more in males than females, hence can be utilized as a valuableparameter for gender determination. Our results are againconsistent with other reports (Surekha*et al*., 2012; Paliwal *et al*., 2010; Sumathi*et al*., 2011; Shanmugam*et al*., 2012), however some havereported a high proportion of straight patterns in India and other parts of world (Kapali *et al*., 1997; Mohammed*et al*., 2014; Nayak*et al*., 2007). Thus,difference in predominant shape was noted in differentgeographical regions within India and around world, in future distinct variables such as rugae shape can be better implemented for populationdifferentiation and gender discrimination.All the rugae patterns analyzed in our study wereunique to each subject and did not show similarity withany other persons, reflecting the individuality of thesepatterns.

Conclusion

It can be concluded that the rugae pattern and orientation differ among Konkan population as compared to different population around the world and thus the mapping of rugae pattern can be of great help in forensic science. The curvy and wavy rugae shape distributions were predominant in Konkan population.Throughliterature analysis, it is evident that there is no determinatesignificance among genders. Based on the rugae patternsalone, population identification also becomes difficult assimilar patterns are seen in different population groups.The interpretation of the present study results are precluded that by limited sample size and therefore the study should be followed with larger sample size to validate our findings.

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