ORIGINAL ARTICLE

Association of Rugae Pattern with Skeletal Malocclusion in Orthodontic Patients Visiting Tertiary Care Hospital

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ABSTRACT

Background: The palatal rugae are special constructions that are inalterable in their position and pattern during the lifestyles of an individual. This imparts them an exceptional role in the forensic dentistry and may play potential role in malocclusion identification. This study was aimed to see association of rugae pattern with sagittal skeletal malocclusion in orthodontic patients visiting tertiary care hospital.

Methods: This cross-sectional examination was completed on pretreatment records (lateral Cephalometric radiographs and maxillary dental casts) of 384 subjects at the orthodontic department of Ziauddin Dental Hospital, Karachi. The study duration was from January to July 2019. The samples were sub-divided into three sagittal skeletal groups based on ANB angle proposed by Steiner's on lateral Cephalometric radiographs (Class I with ANB angle between 0° to 4°; Class II: ANB angle greater than 5°; Class III: ANB angle less than 0°). The shapes of three most-anterior primary rugae were then evaluated bilaterally using Kapali et al., Classification. Chi Square test was applied to find association of rugae pattern among sagittal skeletal malocclusions groups.

Results: Circular and curved rugae shapes were the most prevalent in all skeletal malocclusions. The primary palatal rugae pattern was seen to be significantly different among three skeletal malocclusion groups ($p<0.05$). The right and left sided palatal rugae pattern showed significant difference in all three skeletal malocclusion groups ($p<0.05$).

Conclusion: The present study showed no specific palatal rugae pattern associated with sagittal skeletal malocclusion. Further studies on larger sample and use of modern 3D technologies to scan the maxillary casts are required for results that are more precise.

Keywords: Palate; Rugae; Skeletal; Sagittal; Malocclusion; Dental Casts; Dental Radiographs.

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INTRODUCTION

Palatine rugae are permanent small ridges present on the anterior part of the hard palate and because of their typical pattern of orientation are unique to each individual. Palatal rugae (PR) are anatomical folds of the oral mucosa present on the anterior third of the palate bilaterally behind the incisive papillae. Their number, shape, size and area differ on both left and right side of the hard palate and vary from person to person[1]. Study of various types of the palatal rugae is called Rugoscopy and is used widely in forensic dentistry. It has been proved PR patterns are specific for different racial groups and thus play a special role in population and gender identification[1-6].

Teeth and PR have been linked as both form during the similar time of intrauterine life and are governed by genetic effects therefore one can assume the

relationship exists between the two. PR serves as stable landmark and thus plays a significant role in clinical orthodontics[7-9]. Orthodontists have used PR as stable reference landmarks for the superimposition of pre and post-treatment cephalometric tracings and as a reliable reference point to evaluate the extent of orthodontic tooth movement. The significance of Rugoscopy merits its accurate assessment. Orthodontist have always given importance to the early diagnosis of malocclusion and are always in search for non-invasive tool for the early diagnosis of malocclusions PR pattern is set up at an early age and thus can be used as an additional tool for early diagnosis of malocclusions[1,5-10]. Furthermore, with timely identification of malocclusion preventive and interceptive treatment modalities using growth modifications with functional and orthopedic appliance can be done to improve sagittal skeletal relationships. Early treatment in adolescence maximizes the skeletal effects, reduces the severity of skeletal problem and cost of treatment[11-14].

Researchers have evaluated the differences in palatal rugae pattern in different population[11-13] and have conducted various studies. However, only few studies have been conducted in past to evaluate the association of rugae pattern with different skeletal and dental malocclusions[14-19]. Oral et al.[17] reported wavy and curved rugae pattern to be predominant in all sagittal skeletal malocclusions. Fatima and Fida[18] in their study reported no particular pattern was related within different sagittal skeletal pattern. Literature search shows conflicting evidence for association of palatal rugae pattern with different skeletal and dental malocclusions[14-19]. Unfortunately, there was only one study available in our country, which was done[18] therefore the present study was designed to validate the finding in our local population. The objective of current research was to see association of Rugae pattern with skeletal malocclusion in orthodontic patients visiting tertiary care hospital and to determine the most common palatal rugae pattern in different skeletal malocclusions.

METHODS

We conducted this cross sectional study at Out Patient Orthodontic Departments of Ziauddin Hospital, Karachi from January to July 2019. The research committee of Ziauddin University approved the study. The sampling technique was convenient sampling. The sample size was calculated to be as 384 individuals by using the following formula Sample size formula $n = z^2 p (1- p)/ d^2$ the power of study was kept 80% with anticipated proportion of 50% at 95% confidence level. The inclusion criteria of the study was subjects with age range between 13 to 30 years and great-quality pre-treatment maxillary dental cast and lateral cephalometric radiographs. Patients with previous history or ongoing orthodontic treatment, extractions, history of palatal surgery, craniofacial and dental anomalies, history of thumb/finger sucking and tongue thrusting were excluded from the study[14-18].

The study sample of 384 individuals were further sub-divided into three sagittal skeletal groups based on ANB angle proposed by Steiner's on lateral Cephalometric radiographs (Class I with ANB angle between 0° to 4°; Class II: ANB angle greater than 5°; Class III: ANB angle less than 0°). There were 142 subjects in each skeletal class I and II group and 100 subjects in skeletal class III group. The PR design was outlined on the pre-treatment maxillary dental casts with a sharp HB pencil under satisfactory light and amplification. The shapes of palatal rugae were then assessed on pre-treatment maxillary dental casts using the Kapali et al. classification20 as shown in Figure 1 and 2. Analysis of data was done on IBM SPSS for Windows version 20. Chi square test was computed to see the association of Rugoscpoy with three skeletal malocclusion groups, p-value ≤ 0.05 was considered as statistically significant.

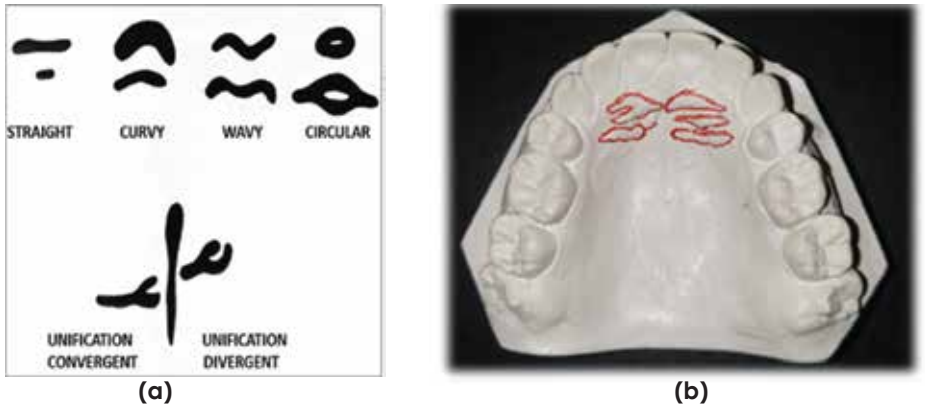

Figure 1a: Classification of palatal rugae shapes, 1b different palatal rugae pattern delineated on dental cast.

RESULTS

Out of total 384 subjects, there were 37% each in skeletal Class I and II groups and 26 % in Skeletal Class III group. The most prevalent pattern of the first primary palatine rugae on the right side of the palate in skeletal Class II and III malocclusion is circular; however, nonspecific rugae pattern was seen for the skeletal Class I malocclusion and the difference was statically significant (p=0.047). Circular rugae pattern was most common in all three malocclusions on the left side and the difference was statistically significant (p=0.009).

Statistically significant difference in pattern of second primary palatal rugae was seen on both the right and left side among three skeletal malocclusion groups (p<0.05). Curved rugae pattern was commonly seen in skeletal class I and III malocclusions on the right side; however, no particular rugae pattern was seen in the skeletal class II malocclusion group. On left side, wavy pattern was predominant in skeletal class I, straight in skeletal class II and curved pattern in skeletal class III malocclusion (Table 1).

The pattern of third primary palatal rugae on both the right and left side was found to be significantly different among three skeletal malocclusion groups (p<0.05). Circular rugae was predominant among all three skeletal malocclusions on right side; however, on left side straight rugae pattern was seen in both Skeletal Class II and III and wavy in Skeletal class I malocclusion.

Table 3: Stratification of GDM with respect to gestational age (GA), patient age and parity.

Pattern of Primary Palatal Rugae							
First Right	**Wavy**	**Circular**	**Straight**	**Curved**	**Unification convergent**	**Unification divergent**	***p*-Value**
Skeletal Class I	2	7	7	7	2	5	0.047
Skeletal Class II	1	12	7	2	6	2	
Skeletal Class III	2	15	0	8	2	3	
First Left							
Skeletal Class I	2	11	5	9	3	0	0.009
Skeletal Class II	3	12	3	2	5	5	
Skeletal Class III	0	14	6	0	3	7	
Second Right							
Skeletal Class I	6	2	4	14	3	1	0.030
Skeletal Class II	8	2	7	5	3	5	
Skeletal Class III	2	2	11	14	1	0	
Second Left							
Skeletal Class I	15	5	2	4	1	3	0.004
Skeletal Class II	4	2	13	6	4	1	
Skeletal Class III	9	1	7	10	3	0	

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Third Right							
Skeletal Class I	10	10	5	5	3	2	0.0118
Skeletal Class II	8	13	7	----	2	0	
Skeletal Class III	8	14	1	----	7	0	
Third Left							
Skeletal Class I	17	0	3	6	1	3	0.016
Skeletal Class II	7	2	12	7	2	0	
Skeletal Class III	8	0	9	7	5	1	

*N=384; Chi-square test * Level of significance < 0.05*

DISCUSSION

The present study showed no specific palatal rugae pattern in different skeletal sagittal malocclusions. Therefore, in order to differentiate the RP among different skeletal sagittal malocclusions, there must be an additional tool for differentiating the sagittal skeletal malocclusions.

Barbo et al.[21] in 2018, reported sinuous palatal rugae to be most prevalent, followed by angular, curved, and straight, which established over 90% of the rugae shape. Saini and Garg[22] in North and North East Indian populations reported sinusoidal RP; however, Studies conducted Azab et al.[23] in Egyptian population, oral et al.[17] in Turkish population and Kapali et al[20] in Australian aborigines and Caucasians reported wavy type as predominant rugae pattern. However, in the present examination the most prevalent rugae shape was circular trailed by curved pattern. The distinction in hereditary cosmetics could be the purpose reason behind ethnic variety in study results. Kapoor et al.[24] in 2015 conducted a pilot study on 66 pre- treatment study maxillary casts to access palatal rugae pattern in Angle's Class of malocclusions namely Class I, Class II div1, Class II div2 and Class III. They reported curvy pattern to be predominant in all malocclusions; however, forking-diverging rugae type was seen Class I and Class III patients on left side of palate.

Oral et al.[17] in 2017 performed a study on Turkish orthodontic patients presenting with different anterio-posterior malocclusion to evaluate their rugae pattern. They studied 105 maxillary casts of patients having age range between 10-22 years which were according to skeletal malocclusion were divided into three groups(Class I, Class II, Class III). They found Wavy, curved rugae shapes to be prevalent, and further reported insignificant difference in rugae pattern in skeletal groups. However, in the present study shape of palatal rugae on the right and left sides of the palate differed significantly among skeletal malocclusion group.

Lalitya et al.[25] evaluated the association between rugae pattern and skeletal malocclusions. The maxillary casts of 90 adolescent subjects having age range between 13-18 years were examined. They divided entire sample according to their ANB angle, WITS appraisal and beta angle measured on lateral cephalograms into three skeletal equal groups. Their study results displayed no specific rugae shape association with any particular sagittal skeletal jaw. Hence, they failed to establish rugae pattern as interpreter of sagittal skeletal morphologic pattern. The findings of our study are consistent with the results of the above study.

Farheen and Fida[18] conducted a study on 165 pretreatment maxillary casts of orthodontics patients to evaluate association between morphological characteristics of palatal rugae and sagittal skeletal relationships. They divided the sample equally into three skeletal groups. They reported significant differences in the palatal rugae patterns among the three skeletal groups ($p<0.05$) however, insignificant difference was found at rugae 2 and 3 on the left side ($p>0.05$). Our study results differed slightly as significant difference in rugae pattern was seen among all three skeletal malocclusion (Class I, II and III) when recorded for left and right side.

The confinements of our investigation were manual tracing of dental casts by which were done by the principal researcher to assess the rugae pattern. Further studies are recommended on larger sample and use of sophisticated instruments and 3D scanners studies are required to assess the PR pattern for progressively solid results.

CONCLUSION

The current study showed no specific palatal rugae pattern among the sagittal classes of skeletal malocclusion. Therefore, it is too early to utilize palatal rugae as supplemental device for the distinguishing different skeletal malocclusion.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

ETHICS APPROVAL

The research committee of Ziauddin University approved the study.

PATIENT CONSENT

Informed consent was taken as per departmental protocol before starting the orthodontic patient.

AUTHORS' CONTRIBUTIONS

DA analyzed and interpreted the patient data. DS, NR and FS collected the data, SM, FM and NR contributor in writing the manuscript and SM supervised the whole research.

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