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Assessment of Size, Shape, and Position of Palatal Rugae and their Association to Types of Malocclusions in Taif City, Saudi Arabia: A Retrospective Cast-Based Study

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Abstract

Objectives*:** 1) Study the predominant palatal rugae characteristics in Angles classes of malocclusions. 2) Statistically relate the major palatal rugae characteristics with Angles classes of malocclusions and thereby study the probability of employing it in forecasting malocclusions. ***Materials and Methods: The data for classifying malocclusion was obtained from the patients' clinical records. Study casts of the palate of 100 healthy orthodontic patients were included as Class 1, Class 2 and Class 3 respectively. Palatal rugae characteristics for all groups were recorded and Class 2 was compared with Classes 2, and 3 according to angles classification and analyzed. Distribution of 100 study casts for the study- 34 Class 1; 34 Class 2 and 32 Class 3. ***Inclusion Criteria:*** 1) The casts were categorized into class 1, 2 and 3 based on the ANB angle of 0-4 degrees for class 1, more than 4 degrees for class 2 and less than 0 degrees for class 3. 2) No previous orthodontics treatment. 3) No anomalies. ***Exclusion Criteria:*** 1) Study casts of inferior quality. 2) Records of any patient having history of previous anomalies affecting the maxilla rugae. ***Statistics*:** Predominant palatal rugae data of groups was entered in SPSS (version 10.0) software and statistically analyzed using ANOVA test to assess the differences between Class 1, 2 and 3 malocclusions study casts for the palatal rugae. Palatal rugae size (length) and number analysis shall be using Krukas-wallis test. The Pattern (Shape) and orientation (Position) of the palatal rugae shall be assessed using chi-square test. ***Results*:** Wavy and complex rugae were prevalent in Class 1 and 3 malocclusions and showed statistically significant difference between Class 1, 2 and 3 malocclusions (p=0.00, 0.014 and 0.016 respectively). The wavy pattern was higher in Class 1 and horizontal and complex higher in Class 3. ***Conclusions*:** Predominant palatal rugae can be considered on vaticination of malocclusions, still, clinical correlation is must. Further studies could be accepted to develop digital styles to identify predominant palatal rugae and prognosticate malocclusion.

Keywords: Palatal rugae; Malocclusion; Angle class 1; Angle class 2; Angle class 3.

INTRODUCTION

The palatal rugae are distinctive structures that are in adjustable in their position and pattern during the life of an existent. This exposes them a special part in the forensic Dentistry, having implicit counteraccusations in the process of mortal identification [1-3]. Study of palatal rugae (PR) is called ruguscopy and is a crucial area in any study involving rugoscopy. PR have been mugged directly [4] from the case's palate or dental prints made and casts poured [6]. Filmland of palate area of casts with a standardized angle of 450 has been successfully used for rugoscopy [7]. In both these styles, acquiring a 2D

snap of PR pattern was suitable for classifying PR. Metrograph was used to digitize ruga points in an X-Y-Z match system [8, 9]. van der Linden used the Optocom to record 3D information of dental casts [10]. Hoggan & Sadowsky used a flatbed scanner to checkup the casts and Corel Photo Paint to publish the images of rugae. still, a 0- 5 exaggeration error was reported in this system [11]. A slide caliper was used under a magnifying glass to measure the ruga directly on dental casts [12]. Rajcich & Sadowsky used photocopies of maxillary casts to measure dental and palatal milestones that also involved a significant 10 exaggeration error [13]. Other digital styles involving 3D technology to record and dissect PR characteristics are meager. Thus, amongst the different styles available for PR accession, direct cast analysis is considered accurate for recording PR characteristics (PRC). Palatal rugae are stable intraoral milestones that are established in early intrauterine life. They've been likened with fingerprints [14] due to their stability that remains throughout life as well as their eventuality of rejuvenescence after destruction with the same pattern as ahead [15]. They've been used as dependable reference milestones during orthodontic tooth movement [16]. There have been studies on halves that revealed PRC are analogous but not identical [17]. Therefore, it can be said that PR pattern is established veritably beforehand in life and the development and pattern are explosively governed by inheritable goods. Since, teeth and PR deconstruction develop during the same period of intrauterine life and genetics plays determining factor, it can be hypothecated that they bear relationship. Dental malocclusions are third most generally being oral conditions encyclopedically, and are extensively current (42.8) in Abha, Asir region of Saudi Arabia [18]. Inheritable predilection is the most constantly accepted etiology for this condition. Early opinion and interception of developing malocclusion can lead to high degree of respectable prognostic with minimal orthodontic and surgical intervention [20]. The popularly used bracket for dental malocclusion is grounded on the relationship of maxillary and mandibular endless first molars proposed by Angle [21]. Angles bracket, however considered as lower protean, is accepted as a dependable system that avoids intra-observer bias [22]. There's no report of the relationship of malocclusion types and specific rugae pattern.

Hence, the specific objects of the study were.

1. Study the predominant palatal rugae characteristics in Angles classes of malocclusions.
2. Statistically relate the major palatal rugae characteristics with Angles classes of malocclusions and thereby study the probability of employing it in forecasting malocclusions.

MATERIALS AND METHODS:

The data for classifying malocclusion was attained from the cases' clinical records. As the records were retrieved from the orthodontic division of the preventive dentistry department, where consent form is taken from all the reporting patients for the records, this study excluded from being applying for an ethical approval from the IRB. Study casts of the palate of 100 healthy orthodontic cases were included as Class 1, Class 2 and Class 3 independently. Palatal rugae characteristics for all groups were recorded and Class 1 was compared with Classes 2, and 3 according to angles bracket and anatomized.

Samples Study Models & Statistics:
34 – Class 1; 34 – Class 2; 32 – Class 3.

ANOVA, which stands for Analysis of Variance, is a statistical test used to dissect the difference between the means of further than two groups. Palatal rugae size (length) and number Krukas-wallis test- The Kruskal – Walli's test (1952) is a nonparametric approach to the one- way ANOVA. The procedure is used to compare three or further groups on a dependent variable that's measured on at least an ordinal position. Pattern (Shape) and exposure (Position) – ki- Forecourt test. The purpose of this test is to determine if a difference between observed data and anticipated data is due to chance, or if it's due to a relationship between the variables you're studying.

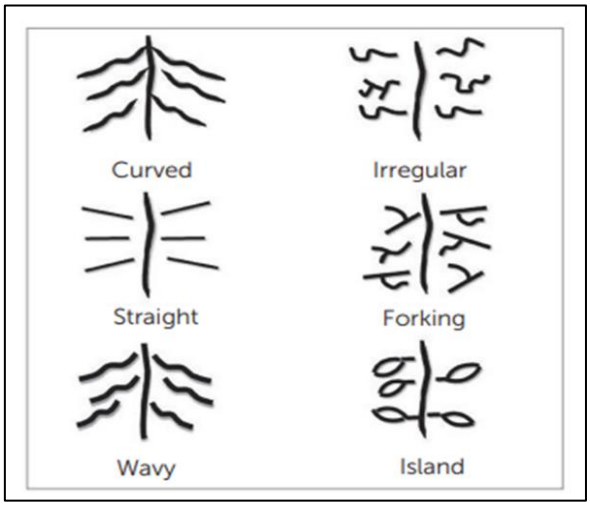

Figure 1: Size [Length] and Shape [Pattern]

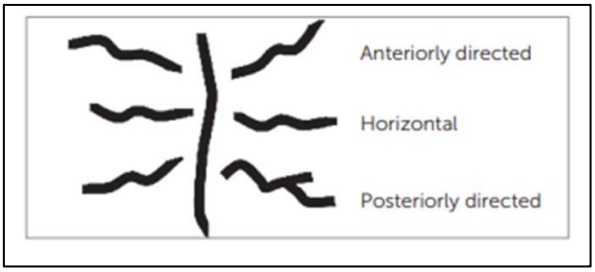

Figure 2: Position [Anterior, Posterior and Horizontal]

Figure 3: Study Casts and Intra oral maxillary occlusal photos of samples for Angels Class 1, 2 and 3. [Left to Right]

Table 1: Statistical table showing values for Size [Length] of predominant palatal rugae. (p<0.05)*

Length of primary rugae (mm)		Class 1	Class 2	Class 3	P-value
First	Right	7.7+/-1.4	7.4+/-1.3	7.6+/-1.1	0.26
	Left	8.7+/-1.5	7.9+/-1.4	8.5+/-1.3	<0.002*
Second	Right	9.8+/-1.2	9.4+/-1.1	9.6+/-1.4	0.36
	Left	8.5+/-1.6	8.9+/-1.3	9.5+/-1.2	0.45
Third	Right	9.7+/-1.5	9.9+/-1.2	9.5+/-1.1	<0.003*
	Left	10.2+/-1.5	10.3+/-1.1	10.5+/-1.4	<0.001*

Table 2: Statistical table showing values for Shape [Pattern] of predominant palatal rugae, (p<0.05)*

Patern of primary rugae			Class 1	Class 2	Class 3	P-value
First	Right	Curved Straight Wavy Irregular Forking Island	Curved and wavy pattern was more significant in class 1 malocclusions on both sides. Curved and Irregular pattern was more significant in class 3 malocclusions on both sides.			0.002*
	Left	Curved Straight Wavy Irregular Forking Island				
Second	Right	Curved Straight Wavy Irregular Forking Island	Curved pattern was more significant in all malocclusions.			0.001*
	Left	Curved Straight Wavy Irregular Forking Island				
Third	Right	Curved Straight Wavy Irregular Forking Island	Curved pattern was more significant in all malocclusions.			0.001*
	Left	Curved Straight Wavy Irregular Forking Island				

RESULTS

Mean age of the study sample was 13.8 ±2.4 times. Mean number of the palatal rugae was9.18 ±2.4, with significant differences among different malocclusion groups. Table 1 shows the length of the first rugae on the left side and third rugae on both sides varied significantly among the groups (p<0.001). Table 2 shows the curved and wavy pattern of the predominant rugae more significant in class 1 and irregular patterns in the class 3 respectively. The second palatal rugae was curved in all three types of malocclusions. It was also found to be similar with third rugae results too. Regarding the position of the predominant palatal rugae the Table 3. shows that all three types of classes of malocclusions had anteriorly and posteriorly directed predominant rugae but class 3 showed more significant horizontal directed rugae.

Table 3: Statistical table showing values for Position [Anterior, Posterior or Horizontal] of predominant palatal rugae, (p<0.05)*

Patern of primary rugae			Class 1	Class 2	Class 3	P-value
First	Right	Posteriorly directed	24	22	29	0.10
		Horizontal	8	7	5	
		Anteriorly directed	12	13	15	
	Left	Posteriorly directed	24	31	38	0.002*
		Horizontal	12	7	2	
		Anteriorly directed	10	10	3	
Second	Right	Posteriorly directed	12	17	16	0.15
		Horizontal	6	7	9	
		Anteriorly directed	25	26	28	
	Left	Posteriorly directed	22	26	40	0.003*
		Horizontal	12	6	5	
		Anteriorly directed	10	8	7	
Third	Right	Posteriorly directed	22	26	40	0.17
		Horizontal	12	6	5	
		Anteriorly directed	10	8	7	
	Left	Posteriorly directed	18	22	27	0.005*
		Horizontal	6	3	3	
		Anteriorly directed	24	8	7	

DISCUSSION

First of its kind study in the western region of Saudi Arabia population. Veritably predictable results for the identification of malocclusions were obtained. Forensic identification through palatal rugae becomes important in cases where fingerprints are unapproachable. (14) Palatal rugae are composed of collagen filaments that are resistant to stretching and bruise, allowing posthumous examination of this area [23]. In addition, studies have reported that palatal rugae are unique to every existent [25-27]. In this present study, each subject's palatal rugae were set up to be unique. Some authors suggest that palatal rugae remain unchanged as of 12th weeks of intrauterine life [29] whereas other authors suggest that palatal rugae may change in number with adding age but retain their general configuration [30]. Due to their unique and stable structure, palatal rugae can be used in forensic identification [31]. Several authors anatomized palatal rugae and proposed colorful groups to estimate them. Several authors analyzed palatal rugae and proposed various classifications to evaluate them [12, 32, 6, 33]. The present study used direct cast analysis as it is considered accurate for recording PR characteristics (PRC).

We found in our study that the size, shape, and position in palatal rugae among different malocclusion

groups were different with statistical significance values. The length of the first rugae on the left side and third rugae on both sides varied significantly among the groups ($p<0.001$). The curved and wavy pattern of the predominant rugae more significant in class 1 and irregular patterns in the class 3 respectively. The second palatal rugae was curved in all three types of malocclusions. It was also found to be similar with third rugae results too. Regarding the position of the predominant palatal rugae all three types of classes of malocclusions had anteriorly and posteriorly directed predominant rugae but class 3 showed more significant horizontal directed rugae.

Limitations:

It's pilot study conducted on a veritably small sample size. Further studies are demanded to substantiate the pungency of using palatal rugae for identifications of malocclusion at an early age. Digital period technologies like scanners can be used in unborn studies to make this study more intriguing.

CONCLUSIONS

Predominant palatal rugae can be considered on vaticination of malocclusions, still, clinical correlation is must. Further studies could be accepted to develop digital styles to identify predominant palatal rugae and prognosticate malocclusion.

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