



RESEARCH ARTICLE

PALATAL MARKERS FOR MALOCCLUSION – A MODEL ANALYSIS

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ABSTRACT

This study was done to determine different palatal rugal patterns amongst untreated patients with class I, class II and class III malocclusion and hence use it as an additional criteria for classifying malocclusions. 4 parameters (Mean Length, Mean Width of Rugae, Total number of Rugae present and Presence or Absence of Union of any rugae) were taken to assess any significant feature present amongst the above mentioned malocclusions. It was found that in Class II Malocclusion, there was no union of rugae present and the Mean Width of Rugal Patterns amongst males was significantly higher when compared to females.

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INTRODUCTION

"Plica Palatine Transversa" as they are called, are present on the anterior 1/3rd region of the hard palate behind the incisive papilla and on either side of the mid palatine raphe (Amasaki et al., 2003). Rugal Patterns remain static with increase in growth and are shielded away from external injuries. The connective tissue covering the palatine process of the maxilla which is under the epithelial-mesenchymal interactive control begins to initiate during the 3rd month of Intrauterine life (Amasaki, 2003). During the embryonic stage, when the Crown-Rump Length (CRL) which is the total length measured from the top of the head (crown) to the bottom of the buttocks (rump) is about 32 mm, the first rugae are seen next to the incisive papilla. As growth and development progress into the prenatal stage, the rugal prominence (Buchtová, 2003) is greatly increased and they acquire the final shape at the end of the adolescent stage (Yamazaki, 1962). The shape of the rugae does not alter but the size may increase as the growth of the palate occurs (Jordanov, 1971 and Lang, 1984). One of the main functions of the palatal rugae is swallowing and greatly

enhances taste reception in tandem with the tongue (Buchtová, 2003) and aid in speech and suction in children (Thomas, 1987). First reported palatal rugae being a stable landmark in dental cast analysis was done by Almeida et al (Almeida, 1995), Bailey et al (Limson, 2004) and Patil et al. (Muthusubramanian, 2005). None of the characteristics of rugae are altered by eruption of teeth but it has been noted that a slight change in the rugal position adjacent to the alveolar ridge post tooth extraction has been reported (Caldas, 2007). There have been reports of rugal pattern changes seen due to finger sucking and constant pressure applied as a result of orthodontic treatment. The Purpose of this study was to assess if few parameters can be correlated to pre-existing malocclusion in untreated individuals and if there is any statistically significant finding so that the parameter may be additionally used for classifying malocclusions.

MATERIALS AND METHODS

The study was done on maxillary casts of 80 untreated individuals within the age group of 18 - 25 with Class - I, Class - II Div.1, Class - II Div.2 and Class - III malocclusion in the Department of Orthodontics and Dentofacial Orthopedics. The impressions were made with Alginate (Tropicalgin™) impression material and the casts were poured using

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Orthokal™ Class III Dental Stone and bases poured. These models were then thoroughly examined for presence of any voids or bubbles and were removed. The models were then placed on a dark background and photographed using a Digital SLR camera. 6 models were discarded as they did not contain adequate detail of the rugal pattern. A Midline was drawn from the middle of the central incisors to the distal most surface of the cast and used as a reference line.

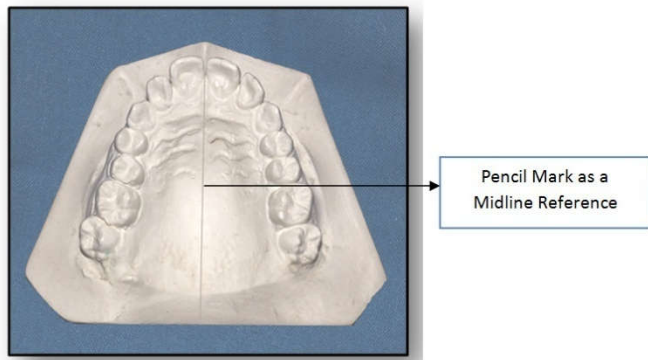


Figure 1.

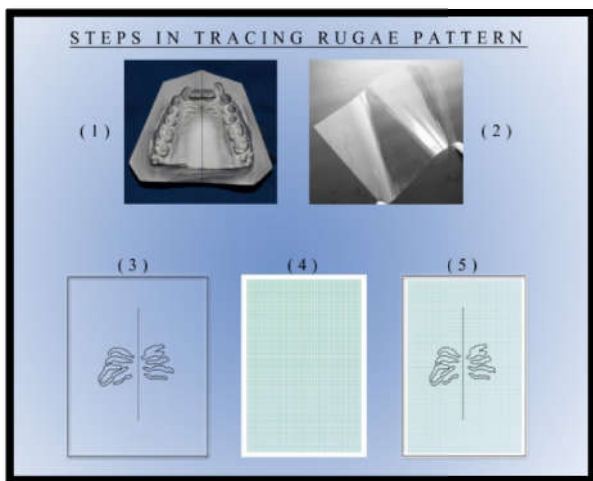


Figure 2.

The following are the steps to trace the rugal patterns:

- The Photograph was placed on a flat surface.
- Overhead Projector Sheets (OHP) 100 microns in thickness were placed over the photograph and using a OHP Stabilo Pen, the rugal patterns were traced along with the central line which is used as a vertical reference line.
- The Figure.2 depicts a completed rugal tracing with the reference line.
- A regular graph paper was taken.
- The rugal tracing was placed over the graph sheet and the patterns were assessed for Length and Width of the rugae.

Assessment of rugal patterns

- The Total number of rugae was counted from each of the photograph.
- The Thickest portion of each rugal pattern were taken into consideration and using the graph paper placed beneath the OHP sheet, the number of 1mm squares within the thickest portion of each rugal pattern was counted and the Mean width for each individual was tabulated.
- Every individual's rugal pattern was assessed for presence or absence of union of rugae.
- The length of the rugae was calculated by counting the number of 1mm squares within the rugae when placing the OHP sheet over the graph paper and tallying the Mean Length of the rugae for every individual.

Statistical methods used

- Individual T Test
- One way ANOVA (Analysis of Variance)
- Chi Square Test

Independent T Test

Table 1.

Parameter	Sex	Number	Mean	Standard deviation	P - value
Length of rugae	Male	34	8.3506	1.38231	0.454
	Female	40	8.0555	1.25138	
Width of rugae	Male	34	1.1176	0.21528	0.000
	Female	40	1.0375	0.13337	
Number of Rugae	Male	34	7.2941	1.56727	0.510
	Female	40	7.3750	1.33373	

One way ANOVA

Table 2.

Parameter	Malocclusion	Number	Mean	Standard deviation	P - value
Number of Rugae	Class i	55	7.5636	1.44995	0.073
	Class ii div 1	8	7	1.06904	
	Class ii div 2	4	7	0	
	Class iii	7	6.1429	1.57359	
Length of Rugae	Class i	55	8.238	1.38335	0.651
	Class ii div 1	8	7.8237	1.02296	
	Class ii div 2	4	7.7075	0.81651	
	Class iii	7	8.5186	1.3025	
Width of Rugae	Class i	55	1.0636	0.16817	0.474
	Class ii div 1	8	1.125	0.23146	
	Class ii div 2	4	1	0	
	Class iii	7	1.1429	0.24398	

Chi Square Test

This was done for 2 sets of variables; one comparing Malocclusion with Presence or absence of union of rugae and the other comparing Malocclusion with the Sex of the individual.

Malocclusion and presence/absence of union of rugae

Table 3.

		Number of united rugae present / absent			TOTAL
		0	1	2	
Malocclusion	Class I	52 94.50%	1 1.80%	2 3.60%	55 100.00%
	Class II Div 1	8 100.00%	0 0.00%	0 0.00%	8 100.00%
		Class II Div 2	4 100.00%	0 0.00%	0 0.00%
	Class III	6 85.70%	1 14.30%	0 0.00%	7 100.00%
		Total	70 94.60%	2 2.70%	2 2.70%

Table 4.

	VALUE	df	p - Value
Pearson Chi-Square	4.745	6	0.577

Malocclusion and its correlation with the sex of the Individual

Table 5.

			SEX		TOTAL
			MALES	FEMALES	
Malocclusion	Class I	Count	25	30	55
		% within Malocclusion	45.50%	54.50%	100.00%
	Class II Div 1	Count	3	5	8
		% within Malocclusion	37.50%	62.50%	100.00%
	Class III	Count	4	3	7
		% within Malocclusion	57.10%	42.90%	100.00%
	Class II Div 2	Count	2	2	4
		% within Malocclusion	50.00%	50.00%	100.00%
	TOTAL	Count	34	40	74
		% within Malocclusion	45.90%	54.10%	100.00%

Table 6.

	VALUE	df	p - VALUE
Pearson Chi-Square	.615	3	0.893

RESULTS

- From (Table.1), it was evident that with a P value of $p=0.000$, the Mean width of rugal patterns is more amongst the males ($1.1176 \pm 0.21528\text{mm}$) than females.
- It was also noted that amongst the individuals with Class II Div 1 and Div 2, there was a total Absence of Union of the rugae (Table 3).
- The One way ANOVA test performed did not provide statistically significant results, yet it was seen from (Table.2) that the number of rugae was seen to be more amongst females in comparison with those of males ($p=0.073$ signifying that the result was provisionally significant) of which Class I individuals showed the maximum number of rugae amongst all others (Table.2)
- The mean width was seen to be the maximum amongst Class III individuals but with a p value of $p=0.474$ it does not have any statistic significance.

- It was noted that there was no relevance between malocclusion and sex as a criteria as well as statistical significance between the Mean lengths of rugae amongst the study groups.

DISCUSSION

The study of rugae termed "Palatal Rugoscopy" (Caldas, 2007) has long been implicated in many disciplines such as anthropology, forensic identification and probable markers for assessment of malocclusion. The results show that there is a significant increase in the Mean widths of the Rugae amongst males ($1.1176 \pm 0.21528\text{mm}$) when compared to females ($1.0375 \pm 0.21528\text{mm}$). Additionally, there was a total absence of union of rugae amongst individuals with Class II (Division1 and 2) malocclusion. The ANOVA test did not provide any statistically significant results in view of Mean length of rugae amongst individuals with Class I malocclusion. There have been several studies pertaining to rugal patterns; most notably by Almeida *et al* (Almeida, 1995), stating that the rugae remain stable despite any traumatic insult from heat, chemicals or any disease. It is interesting to note that the

direction of the Palatal rugae can change due to extraction of teeth⁹. Its main purpose as proposed by Muthusubramanian et al is that it is a stable landmark¹⁰ within the oral cavity and can be used for forensic identification. However no study shows that the Mean width of the rugae can be used as a parameter for assessing the type of malocclusion in an individual. A sincere effort has been made in standardization of the groups that have been taken and the appropriate selection criteria was followed. There are various methods advocated in recording rugal patterns of which the simplest is the Intraoral inspection. If long term studies are to be done, this method might not serve the purpose of a comparison and the need for a more accurate method is required. Our study was done using Digital photography of the Maxillary casts using a Digital SLR, keeping the magnification ratio constant by maintaining a uniform focussing distance. These images can be preserved¹² in case of long term studies.

Conclusion

The most significant finding of this study was that the Mean Width of Rugal patterns were more than those in female individuals who have not undergone orthodontic treatment. It is worth mentioning that it is a very early stage in the field of dentistry that rugal patterns can be used for classifying malocclusions. Though several parameters were taken for the purpose of correlating malocclusion with those variables, further probing in this path can provide a valuable insight in classifying malocclusions.

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