The reliability of palatal rugoscopy in predicting various malocclusions

A comparative study

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Abstract

Aim Palatine rugae are asymmetrical and irregular elevations of the mucosa located in the palate. Once they are formed they can change in size but their shape remains constant. These formations are considered a landmark during orthodontic treatment. The aim of this study was to identify malocclusion in young individuals through patterns of palatal rugae.

Materials and methods A total of 105 subjects aged 9–14 years were selected for the study. The subjects were divided into three groups based on their malocclusion. Maxillary and mandibular arch impressions were taken using alginate (Algin-Gum) followed by preparation of casts using dental stone. All the casts (n=105) were analyzed and then categorized using the classification of Nayak et al. The samples were evaluated using the Mann–Whitney U test and Kruskal–Wallis ANOVA test.

Results In all the malocclusions, the wavy pattern was prevalent followed by the straight pattern. Nonspecific and curved rugae patterns were the least prevalent patterns. A circular pattern was completely absent.

Conclusion The wavy pattern of rugae was predominant in all types of malocclusions followed by the straight pattern. There was no significant relation between the types of palatal rugae and malocclusion.

Keywords Palate · Rugae · Malocclusion · Rugoscopy · Children

Introduction

Palatine rugae in the human are usually asymmetrical and irregular elevations of the mucosa located in the palate [1]. The first person to describe these palatine rugae was Winslow in 1753 [2, 3]. They appear toward the end of the first trimester of intrauterine life, from the covering connective tissue in the palatine process of the maxillary bone. Their development and growth are mutually controlled by epithelial–mesenchymal interactions. Once the rugae are formed, they may experience changes in size due to growth or injuries to the palate, but the shape remains constant (Waterman 1974) [1].

Palatal rugae are physiologically involved in oral swallowing and help to improve the relationship between food and taste receptors (Buchtovo et al. 1987) [1]. The number of rugae on either side generally varies between three and five. The palatine rugae are located in the anterior half of the hard palate, not extending posteriorly, and they never cross the midline [1].

The use of palatine rugae for identification of humans was first proposed by Allen in 1889 [2, 4, 5]. Trobo Hermosa was the first person to propose palatal rugoscopy in 1932 [2, 4, 5]. These formations have been used in medicolegal identification processes because of their individual morphological characteristics [2, 5–7]. Rugae are also considered a landmark during orthodontic treatment.

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The purpose of this study was to identify malocclusion in young individuals through the palatal rugae. Specifically, we aimed:

1. To evaluate the rugae patterns in children presenting with various malocclusions and to correlate any similarities or differences in the groups observed.
2. To investigate whether the pattern of rugae can be mapped for a category of patients with various malocclusions.

Materials and methods

The present study was conducted among children studying in various schools of Eluru, West Godavari District, Andhra Pradesh. A total of 105 subjects aged 9–14 years were selected for the study. The subjects were divided into three groups based on their malocclusion (see Fig. 1) as follows:

● Group A: Angle's Class I—37 (24 boys and 13 girls)
● Group B: Angle's Class II—38 (28 boys and 10 girls)
● Group C: Angle's Class III—30 (17 boys and 13 girls)

The inclusion criteria for the study were:

● Children between 9 and 14 years of age
● Children presenting with malocclusion

The exclusion criteria for the study were:

● Children with cleft palate
● Children without malocclusion
● Medically compromised children
● Children with special needs

Consent was obtained from the children's parents. Maxillary and mandibular arch impressions were taken using alginate (Algin-Gum) followed by preparation of casts using dental stone. All the casts (n=105) were analyzed by outlining the rugae that were traced using a 0.7-mm pencil and then categorized using the classification of Nayak et al. [8] (Figs. 2, 3, and 4).

The classification of Nayak et al. is based on the shape of the rugae and includes:

1. Straight (S) – rugae run directly from origin to termination.
2. Wavy (W) – rugae are serpentine shaped.
3. Curved (C) – rugae appear as simple crescent shaped, curved gently.
4. Circular (A) – rugae have continuous ring form.
5. Unification (U) – appears when two rugae are joined at their point of origin or termination.
6. Nonspecific rugae pattern (N) – involves rugae that do not fall into any of these categories.

Results

In this present study, we used the classification of Nayak et al. to analyze the patterns of rugae. During the study, no two models showed identical type of rugae patterns. The samples obtained were evaluated using the Mann–Whitney U test and Kruskal–Wallis ANOVA test.

In all the malocclusions, the wavy pattern was prevalent, followed by the straight pattern. The wavy pattern was predominant in all the malocclusions with the highest presence. Nonspecific and curved rugae patterns were the least prevalent patterns. A circular pattern was completely absent.

Fig. 1 Distribution of male and female subjects according to malocclusion class
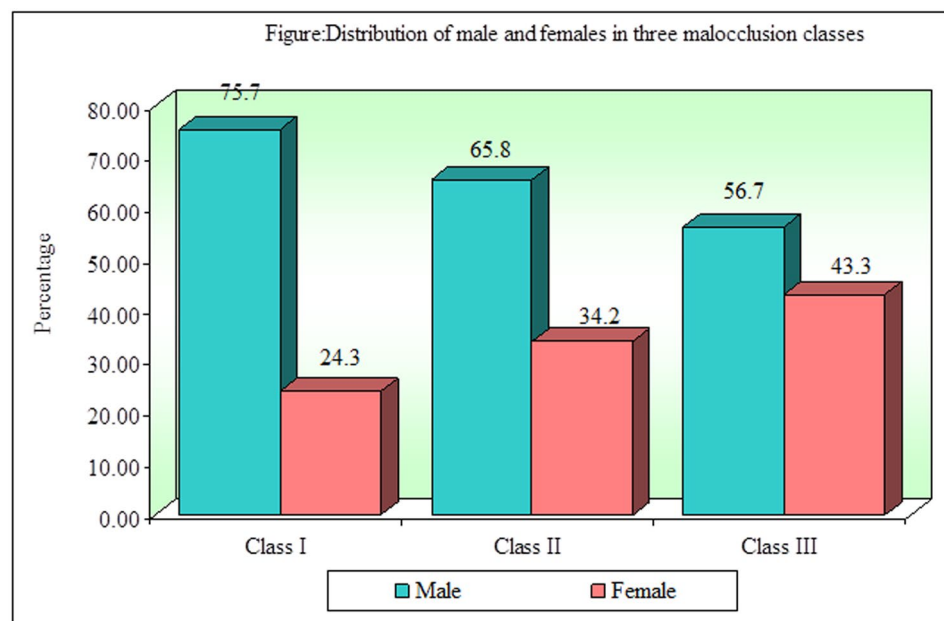
Fig. 2 Materials used in the study
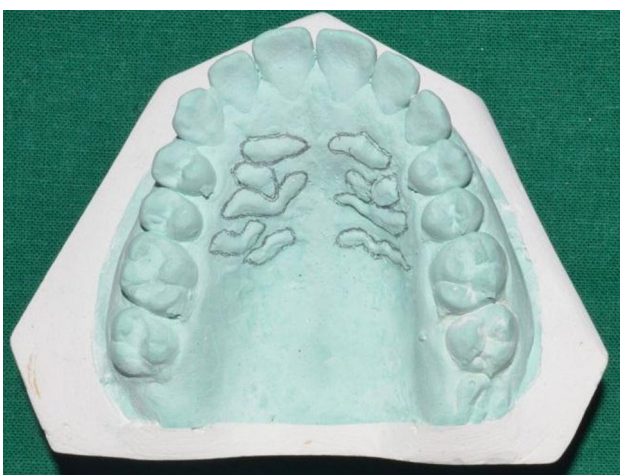

Fig. 3 Taking alginate impressions

Fig. 4 Rugae marked with pencil

Table 1 Data obtained from models

Occlusion	Wavy	Straight	Unification	Curved	Nonspecific
Class I	142	100	27	19	09
Class II	145	93	20	21	10
Class III	96	82	14	12	10

Table 2 Mean and standard deviation of rugae patterns

Occlusion	Summary	Class I	Class II	Class III	Total
Curved	Mean	0.5	0.5	0.4	0.5
	SD	0.7	0.8	0.6	0.7
Wavy	Mean	3.9	3.8	3.3	3.7
	SD	1.6	1.5	1.5	1.6
Straight	Mean	2.6	2.5	2.7	2.6
	SD	1.6	1.3	1.4	1.4
Unification	Mean	0.6	0.5	0.5	0.5
	SD	0.9	0.6	0.6	0.7
Nonspecific	Mean	0.4	0.3	0.3	0.4
	SD	0.6	0.5	0.5	0.5

Table 3 Pairwise comparison of rugae among various malocclusions

Malocclusion	Curved p	Wavy p	Straight p	Unification p	Nonspecific p
Class I vs. Class II	0.5852	0.9990	0.8239	0.7266	0.5962
Class I vs. Class III	0.6140	0.1919	0.7960	0.9849	0.7052
Class II vs. Class III	0.9508	0.2168	0.5953	0.7341	0.9017

Discussion

Identifying malocclusion is a difficult task in young age groups. Various classifications were introduced to assess palatal rugae. Most of the studies were done using the methods of Silva, Carrea, Lysell, Thomas, Kotz, and Kapali et al. [2]. The classification used in the present study is based on the shape of the rugae, and it is simple and reliable [8]. Like fingerprints, the palatal rugae do not change during the lifetime of an individual land they are protected from high temperatures and trauma because of their position in the oral cavity; surrounded and protected by the lips, cheeks, tongue, teeth, and bone, they are unaffected by prosthetic devices [4]. Once formed, they only change in length but not in shape owing to normal growth, and they stay in the same position throughout one's life [9]. Disease, trauma, or chemical attack seems to have no effect on the shape of palatal rugae (Almeida et al.) [1, 4].

It is important to note the existence of abnormal patterns and shapes on palatal rugae. It has been suggested that these abnormal patterns can serve as an additional feature or sign in the diagnosis of cleft palate in humans (Ikemi et al. 2001) [1], and they have been used as benchmarks when testing in pre- and postsurgical cleft palate surgery (Park et al. 1994) [1].

In the present study, the wavy pattern followed by the straight pattern was seen in all cases of malocclusion and

was consistent with the study findings of Kapali et al. in Australian Aborigines and Caucasians [5] and of Preethi et al. [6]. The main drawback of the study was the limited number of subjects; including more subjects in the evaluation might lead to significant results that may be beneficial for the diagnosis of malocclusion in childhood.

Conclusion

We conclude that the wavy pattern of rugae was predominant in all types of malocclusions followed by the straight pattern. There was no significant relation found between the types of palatal rugae and malocclusion.

Conflict of interest
R. Juvva, M.G.S. Prasad, N.R. Ambati, S. Kaniti, N.V.K. Raviteja, and V. Jyothi state that there are no conflicts of interest.

References

1. Sivaraj A. Significance of Palatal Rugae in Orthodontics. J Orofac Res. 2013;3(3):202–9.

2. Koneru A, Shreekanth NG, Husangi S, Hallikeri K, Khare P. Palatal Rugae: An overview in Forensic Odontology. Indian J Forensic Odontol. 2012;5(4):151–56.

3. Karen CDS, Fernendas CNS, Monica CS. Evaluation of a digital methodology for human identification using palatal rugoscopy. Braz J oral Sci. 2011;10(3):199–203-3.

4. Bhateja S, Arora G. Analysis of Palatal RugaeFor Human Identification In Indian (Mathura) Population. Indian J Dent Res. 2013;3(5):24–7.

5. Sujatha S, Himanshu A, Pradeep KR, Ajith K Rugoscopy-An emerging aid in personal identification-A review. Indian J Dent Sci. 2012;4(5):150–53.

6. Preethi S, Sushmitha S, Vanitha R. Comparative reliability of cheiloscopy and palatoscopy n human identification. Indian J Dent Res. 2009;20(4):453–57.

7. Kamal R, Neha G, Amol B, Abhishek S. Palatal rugae patterns as an aid for personal identification: a forensic study. J Indian Acad Oral Med Radiol. 2011;23(3):173–78.

8. Mohammad RB, Rao TH, Rani GS, Chowdhary MS, Prashanti B, Pakki SK. Analysis of various rugae pattern in coastal Andhra population: digitilized method. Oral MaxilloFacPathol J. 2014;5(1):418–22.

9. Kappor P, Kaur h, Kaur R. Rugoscopy: a diagnostic appurtenance for malocclusion or just a forensic aid?—A pilot study. J Forensic Res. 2015;6(2):1–5.