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Comparison of Rugae Pattern Between Dentate and Edentulous Patients in Iraqi Sample

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الخلاصة

الاهداف: إن الغاية من الدراسة هي تحري تغيرات السمات السطحية المتقابلة الحاصلة في منطقة غضون الحنك العلوي بعد الهرم (الشيخوخة)، وفقدان كل الأسنان **المواد وطرائق العمل**:تضم العينة الكلية (40) مشارك عراقي في مجموعتين : ذوي أسنان و فاقدي أسنان كليا، تمت ملاحظة قوالب الفكوك العليا لهؤلاء المرضى بدقة وتدوين العدد والأطوال والسمات النوعية وموقع النهايات الوسطية للغضون (التجعدات) **النتائج**: لقد لوحظت اختلافات عديدة بين المجموعتين **الاستنتاج**:تتغير السمات السطحية لمنطقة غضون الحنك العلوي كثيرا - تغيرات طبوغرافية – بعد الشيخوخة وفقدان الأسنان كليا بصرف النظر عن مدة فقدان الأسنان واستخدام طقم الأسنان إن الصورة الإجمالية لمنطقة غضون الحنك العلوي عديم الأسنان هي تجعدات قصيرة وبسيطة ومتفرقة (مبعثرة) ومتسعة أماما

ABSTRACT

Aim: To explore the volatile topographic changes occurring in the palatal rugae after aging and loss of all teeth. **Materials and methods**: The total sample consists of 40 Iraqi participants in 2 , dentate and edentulous , groups. Their maxillary casts were minutely observed. Number, lengths, qualitative characteristics, and medial position of the rugae ends were recorded. **Results:** Many differences were observed between the 2 groups. **Conclusions**: Palatal rugae were topographically changed greatly after aging and loss of teeth regardless of time of edentulism and wearing dentures. Short , simple , scattered and anteriorly flared is the overall picture of rugae in edentulous palates .

Key Words: Rugae area, Edentulous patient.

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INTRODUCTION

According to the Glossary of Prosthodontics [(1)] , palatal rugae are anatomical folds or wrinkles (usually used in the plural sense) ; the irregular fibrous connective tissues located on the anterior third of the palate behind incisive papilla. They are also called plica palatinae transversae and rugae palatina [(2)] .

Palatal rugae are asymmetric ridges of dense connective tissues extending laterally, on both sides, from the incisive papilla and the anterior part of the median palatine raphe [(3,4)] , and supplied by the greater palatine and nasopalatine branches [(5)] .

The purpose of palatal rugae is to facilitate food transportation through the oral cavity, prevent loss of food from the mouth and participate in chewing process. Due to the presence of gustatory and tactile receptors, they contribute to the perception of taste, texture of food qualities and tongue position during speech [(6,7)] . These important rugae functions encouraged many researchers to reproduce the individual palatal rugae on the dentures' palatal surfaces [(6,8-10)] .

In prosthodontics , rugae area plays an effective role; it is a secondary bearing area that resists anterior displacement of the denture[(2,11)] , it is considered as a part of the primary denture supporting area because it does not affected by resorption [(11)] , sometimes, rugae area is covered to provide indirect retention for free extended denture base [(12)] , and there were efforts to use palatal rugae as a guide in posi-

tioning the artificial maxillary anterior teeth [13] .

Once formed in 3rd month in uterus, palatal rugae do not undergo any changes except in length, due to normal growth [7,14] , and remain stable throughout an entire person's life. However, some events can contribute to changes in palatal rugae including extreme finger sucking in infancy and persistent pressure with orthodontic treatment or dentures [15,16] .

The characteristic uniqueness and genetic basis of the palatal rugae suggest their use in person's identification [7,15,17-20] . Many studies revealed various racial and gender differences [4,21-23].In addition, the characteristic pattern of rugae is considered as a diagnostic feature of submucous cleft palate in 100% of the isolated cleft palate cases [24] .

The supposed overall stability of palatal rugae suggest their use in surveying dentitional changes from year to year and pre – and post –treatment [25-27]. Controversy still exists a bout the stability of quantitative and qualitative characteristics of palatal rugae during growth [3,4,28-29] , orthodontic treatment with and without teeth extraction [30-34] , or as result of edentulism [19] .

The aim of this study is to explore the volatile topographic changes occurring in the palatal rugae after aging and loss of all teeth .

MATERIALS AND METHODS

The Sample : The total sample consists of 40 Iraqi participants in 2 groups **.**The dentate group(20 subjects) was selected among the students of College of Dentistry, Mosul University according to the following criteria : all subjects were healthy,22 to 25 years old, bilateral Cl.I (normal occlusion), having 28 to 32 permanent teeth, and free of congenital abnormalities, previous craniofacial trauma, surgery, inflammation or orthodontic treatment .The completely edentulous group (20 subjects) was selected from the routine patients in the graduate clinics of the Department of Prosthetic Dentistry in the same college according to the following criteria; all subject were normal , 45 to 79 years old, at least 1 year of teeth clearance, and their mouths were free of inflammation.

An irreversible hydrocolloid (alginate impression material) was used on an appropriate perforated metal trays for the upper dental arch for all subjects .The impressions were poured into with dental stone, Every care was taken to make void free casts.

Cast Analysis : The casts were minutely observed with the help of a magnifying lens. A 0.5 mm black graphite pencil was used to highlighted all the rugae with the following landmarks without damage : the center of the incisive papilla (IP) and a line extending from IP and bisecting the median palatine raphe (MPR) (Figure 1). All the quantitative measurements were calculated using electronic digital caliper (IOS–USA) to an accuracy of 0.01mm. The measurements were recorded with two decimals.

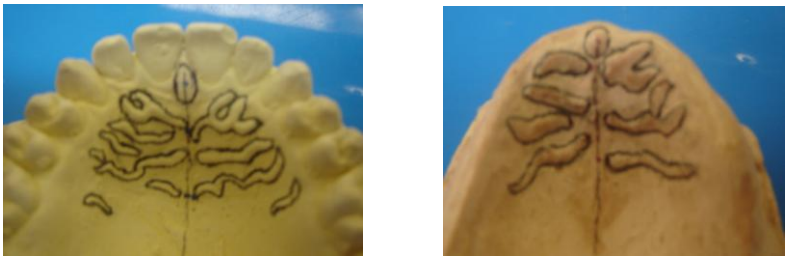

Figure (1**) :** Palatal rugae in dentate and edentulous maxillary casts .

To assess intra-observer variation in interpretation, double determinations were performed for 20 subjects. The intra-class correlation coefficient between the two sets of measurements was exceeding 95% indicating that the dental cast measurement technique was reliable and reproducible.

Number of all rugae was counted on both sides and rugae lengths were recorded and two categories were formed; primary rugae ≥ 5mm, and secondary rugae

< 5mm[4] . Three main primary rugae on each side were chosen; anterior, middle, and posterior[30] . Their shapes were classified into four major types; straight, curved, wavy, and circular (Figure 2).

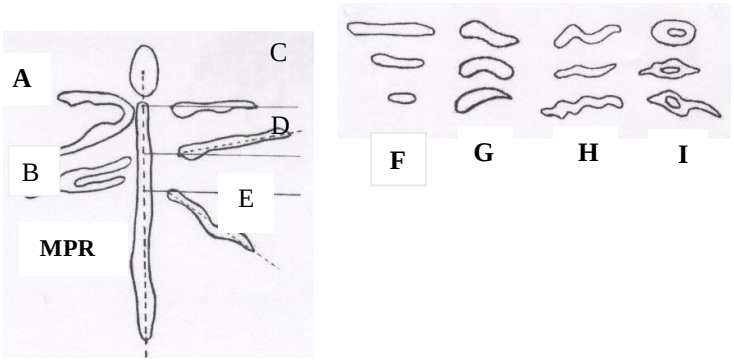

Figure 2: Rugae qualitative characteristics

Straight rugae ran directly from their origin to termination. Curved rugae had a simple crescent shape which curved gently. Evidence of even the slightest bend at the termination or origin of a ruga led to a classification as curved. Wavy rugae, the basic shape of this type was serpentine. However, if there was a slight curve at the origin or termination of a curved rugae it was classified as wavy. Circular rugae display a definite continuous ring formation [4] .

Unification occurs when two rugae are joined at their origin or termination (Figure 2). Unifications in which two rugae began from the same origin but immediately diverged were classified as diverging. Rugae with different origins which joined on their lateral portions were classified as converging .Rugae converged medially and diverged laterally were classified as converged – diverged[4] .

The direction of each main primary ruga was determined by measuring the angle between the line joining its origin and termination and a line perpendicular to the MPR. Forward – directed rugae were associated with positive angles, backward – directed rugae with negative angles, and perpendicular rugae with angles of zero degrees (Figure 2). Although the sample was 40 casts, the number of the tested rugae was 240 (6 right and left main primary rugae in each cast) **.**

The medial position of the main primary rugae was recorded in two terms ;

1. Anteroposterior distance (D1) in relation to IP beginning from the crossing point of a perpendicular falled from the medial ruga point to MPR. 2. The length of the perpendicular was the transverse distance (D2) in relation to MPR . Therefore we have pared anterior D1, middle D1, posterior D1, anterior D2, middle D2, and posterior D2.Accordingly, the tested rugae in recording medial rugae position (D1 and D2) were 80 (Figure 2).

Descriptive statistics were calculated for all valuable measurements. Paired student's t – test was used for comparison between dentate and edentulous groups. Percentages of all the remaining qualitative records were tabulated.

RESULTS

Descriptive statistics for the number of rugae of total sample and dentate and edentulous groups and comparisons between them were illustrated in Table (1).

Table (1) **:** Descriptive static's for number of rugae of both groups.

	Total sample		Dentate		Edentulous		Significance of difference
	Mean N=40	SE	Mean N=20	SE	Mean N=20	SE	
Total no.	8.6	0.3	9	0.5	7.5	0.4	0.003
No. of Primary	7.2	0.3	7	0.4	6.6	0.3	0.01
No. of Secondary	1.4	0.3	1	0.4	1	0.3	0.06

Significant differences were observed between the 2 groups. The rugae count of the total sample has a mean(8.6).The primary rugae (≥5mm length)represent (7.2) and the remaining (1.4) were the secondary(< 5mm length).In edentulous group, total and primary rugae number (7.5 and 6.6 respectively) were significantly lesser than those of dentate subjects (9 and 7 respectively) while secondary rugae means were (1) in both groups. The qualitative characteristics (shape, unification, and direction) were reported in Table (2) as percentages of their frequencies. The complex rugae patterns (wavy, circular and fragmented) in dentate maxillae were greater than those in edentulous ones.

Table (2) **:** Percentages of rugae according to their characteristics.

	Shape					Unification				Direction			
	wavy	Curved	Straight	Circular	Missing values	diverged	Converged	Diverged converged	Missing values	Foreword	Backward	perpendi.	Missing values
Total n=240	46.7	28.8	18.8	2.5	3.3	14.6	3.8	3.8	69.6	44.6	32.1	20	3.3
Dentate n=20	30.4	11.7	5	2.1	0.8	7.1	2.9	2.5	29.2	19.2	17.5	12.5	0.8
Edentulous n=20	16.3	17.1	13.8	0.4	2.5	7.5	0.8	1.3	40.4	25.4	14.6	7.5	2.5

Table (3) shows descriptive statistics, and comparisons between the dentate and edentulous groups . Many differences were observed which rose to be significant especially in the posterior D1, and anterior and middle D2 .

Table (3) : Descriptive static's of medial rugae position of both groups.

	Total sample		Dentate		Edentulous		Significance of difference .
	Mean N=80	SE	Mean N=40	SE	Mean N=40	SE	
Ant. D1	6.5	0.3	6.7	0.4	6.2	*0.3*	0.3
Mid. D1	11.3	0.3	11.7	0.4	10.8	0.4	0.1
Pos. D1	14.6	0.6	16.4	0.6	12.9	0.9	< 0.001
Ant. D2	1.1	0.1	0.9	0.1	1.3	0.1	0.01
Mid. D2	1.6	0.1	1.3	0.1	2	0.2	0.008
Pos. D2	2.5	0.3	2.3	0.3	2.7	0.4	0.4

DISCUSSION

The young participants of dentate group have age range 22 – 25 years which represent within the age of growth completion. After these ages many changes that may occur in the dentition due to the aging process like extensive restorative dental treatment and teeth loss. While the edentulous participants were chosen at least 1 year of teeth clearance, so that the

changes could be detectable.

Although dental casts are important three – dimensional records that have been used most successfully during the diagnosis and treatment planning of prosthodontic patients, they have yet to be used in this task. These casts were exact reproductions of the fleshy palates, showing all the details desired, that could be measured accurately [14] . Recording the points were easily performed. Minimum training was needed to achieve results with low errors. However, eyestrain was a problem and rest intervals were required. Length records were categorized to minimize the errors that could occur if the quantitative scale was retained.

Significant reductions were observed in total rugae number and number of primary rugae, while the number of secondary ones was approximately stable. We suggested that, in edentulous patients, the rugae lengths decrease and the small rugae eliminated or degenerated.

The most common rugae shapes were wavy and curved forms, where as straight and circular types were least common. This agreed with the result of Kapali *etal* [4] who studied a sample of Australian subjects, age range 11 – 57 years with regardless of palatal growth, tooth loss and tooth movement. The shape complexity of the rugae decreased gradually from circular, wavy, curved, to straight which is the simplest form. Circular and wavy shapes were more frequent in dentate group than in edentulous one. Whereas curved and straight shapes were the most prominent in the edentulous group. Other complex figure of rugae pattern is the unification or fragmentation . It was clear that this perplexity of rugae pattern in dentate individuals tend to regress in edentulous group . Ohtani *et al* [19] stated that in edentulous patients , features like poorly demarcated eminence of rugae and non-complex rugae pattern are mainly due to the shape of the edentulous palate itself and rarely due to the dentures and could lead to difficulties in finding unique points for personal identification .This is believed to be a result of the action of the exerted chewing force . The continuous mechanical stimulation can result in many morphological degeneration in the palatal mucosa involving rugae [16].

Forward , backward and perpendicular is the descending manner of rugae direction percentages in both groups .Although the percentage of forward directed rugae is greater than that of backward directed ones in dentate group , this difference is widely increased in the edentulous group . This may attributed to the significant changes occur in the rugae position especially at their lateral ends which were believed to follow the direction of teeth migration; a physiological process that occurs after loss of adjacent teeth ,in connection with the bone resorption at the maxillary arch circumference [31] .

The distances between the medial rugae points and IP appear to be reduced in the edentulous group. This reduction is significant in the posterior rugae. This means that the medial rugae ends were changed in edentulous casts to occupy more anterior position than that of dentate group. This observation may be attributed to a decrease in arch circumference which primarily affects the anterior part of the palate [28] . The distances between medial rugae ends and MPR increase in edentulous palates. We suggest that rugae begin to degenerate and shorten in length from their medial ends. Therefore; palatal rugae in edentulous group occupy more anterior and lateral position than in dentate individuals . Short , simple , scattered and anteriorly flared is the overall picture of rugae in edentulous palates .

No previous studies investigated the palatal rugae changes after aging and loss of teeth were found . Therefore ,comparison with other results cannot be achieved .

More investigations were needed to check about the influence of bone resorption and wearing dentures on the palatal rugae changes .

CONCLUSIONS

Palatal rugae were topographically changed greatly after aging and loss of teeth regardless of time of edentulism and wearing dentures. They possess the following dominant features; reduced number, shorter lengths, lesser complexity and perplexity, more anterior and lateral position than those in young dentate individu-

als.

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