

## Risk Factors Influence on the Prevalence and Severity of Root Caries in Mosul (Rural and Urban)

**Aisha A Qasim**  
BDS, MSc ( Lect)

**Dept. of ortho, pedo, preventive dentistry**  
College of Dentistry, University of Mosul

### الخلاصة

**الأهداف:** تهدف الدراسة الى تحديد العلاقة بين تسوس الجذر و بعض عوامل الخطورة للمسنين من مدينة الموصل (الريف و المدينة). **المواد و طرق العمل:** يتكون النموذج من ( 231 ) شخص تم اختيارهم باعمار تتراوح ما بين ( 20 - 70 ) سنة من الريف و المدينة. اجري الفحص السريري لكل شخص لبيان تسوس سطح الجذور، عمق جيب اللثة و الأسنان المفقودة. استارة الأسئلة تملئ من قبل طبيب الأسنان. مؤشر تسوس الجذور ( RCI ) استعمل لكشف تسوس الجذور، مؤشرات (بيلنك) استعملت لتسجيل شدة تسوس سطح الجذور و مؤشر منظمة الصحة العالمية WHO استعمل لقياس عمق الجيوب. **النتائج:** من كل النموذج ، متوسط مؤشر تسوس سطح الجذر كان 19.37 في الريف و 18.62 في المدينة مع عدم وجود اختلافاً معنوياً بينهما. وقد اظهرت الدراسة ان شدة تسوس سطح الجذور ، درجة 1 (بدائي) هو أكثر انتشاراً لكلا الجنسين. الأشخاص في هذه الدراسة أظهروا علاقة بين بعض عوامل الخطورة ووجود تسوس سطح الجذور. متوسط عمق الجيوب و علاقته مع تسوس سطح الجذر مع عدم وجود اختلاف معنوي بين الريف و المدينة (P> 0.05) . متوسط عدد الأسنان المفقودة يزداد بزيادة العمر في كل من الريف و المدينة. **الاستنتاج:** تسوس سطح الجذور سجل ليكون مرتفع في كل من سكان الريف و المدينة ، خاصة كبار السن. و لهذا فالتدابير العلاجية من كبار السن تنبئ بانهم واحد من التحديات التي تواجه فريق اطباء الاسنان في المستقبل.

### ABSTRACT

**Aims:** To determine the association of root caries with some risk factors among adult population in Mosul City (rural and urban). **Materials and Methods:** A sample of 231 subjects was selected, aged 20-70 years old, from rural and urban areas of Mosul City. For each subject, clinical examination was performed for root surface caries, pocket depth and tooth loss. The questionnaire forms were completed by the dentist. Root Caries Index (RCI) was used for detecting root caries. Billings Index was used to record the severity of root caries, while WHO Index was used to measure pocket depth. **Results:** From the total sample, the mean RCI was 19.37 in rural and 18.62 in urban areas; with no significant difference between them. The study revealed that for severity of the root caries lesion, grade I (incipient) was the most prevalent for both genders. Subjects of this study revealed correlation between some risk factors and the occurrence of root surface caries. The mean pocket depth in relation to root surface caries with not significant difference between urban and rural areas ( $p > 0.05$ ). the mean number of the missing teeth increased with the increasing age in both rural and urban areas. **Conclusion:** Root surface caries is regarded to be high in both rural and urban population, especially those with old age. As such, management of a root caries in older population is predicted to be one of greatest challenges facing dental team in the future.

**Key Words:** Root caries, risk factors.

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### INTRODUCTION

Root caries is a soft irregular progressive lesion occurring at or apical to the cemento—enamel junction. It is caused by the presence of bacterial plaque and the repeated consumption of sugars, which results in the dissolution of minerals from the calcified tissues. Root surface caries are initiated when there is periodontal attachment loss and the root surface become exposed to the oral environmental <sup>(1)</sup>.

Root caries has become an important dental problem because people are living

longer and keeping their teeth longer. As patients grow older, their gum recede and root surface are exposed, making them more susceptible to root caries <sup>(2)</sup>.

The prevalence of root caries increases with age and is greater in the elderly population than in younger adults <sup>(3)</sup>.

Many factors are in essence indirectly linked with root caries and directly linked with each other, but nonetheless are significant contributory factors. Root caries can be found alone, or, often, approximating existing restoration. However, root caries

may only occur where there has been recession of the gingival tissue, leading to exposure of the root surface, or where periodontal pockets exist<sup>(4)</sup>.

There are many factors which set off a chain of events which inevitably lead to this exposure, leaving the root surface susceptible to decay. Among these factors are: Periodontal disease associated with loss of gingival attachment, coupled with xerostomia,<sup>(5)</sup> poor oral hygiene,<sup>(6)</sup> or a cariogenic diet,<sup>(7)</sup> nutritional status,<sup>(8)</sup> chronic medical condition,<sup>(9)</sup> physical limitation,<sup>(10, 11)</sup> multiple medication use that decrease the salivary flow,<sup>(12, 13)</sup> infrequent use of dental services,<sup>(14)</sup> wearing partial denture,<sup>(15)</sup> and large number of missing teeth<sup>(16)</sup>.

Some scientists found that smokers had significantly higher root caries prevalence and incidence than non smokers. Smokers tend to have more exposed root surfaces, deeper periodontal pockets with bleeding on probing and higher root plaque scores.<sup>(17)</sup> Alcohol use,<sup>(18)</sup> radiations treatment for head and neck<sup>(19)</sup> and chemotherapy<sup>(20)</sup> play a role in root caries prevalence.

With more elderly retaining their natural teeth, the need to understand the nature and cause of root surface lesion is of great importance. Preventive measure that include proper oral hygiene, plaque control, fluoride therapy and avoidance of removable dentures are required prior to and after dental treatment<sup>(21-23)</sup>

So, the purpose of this study was to investigate the prevalence of root surface caries and its association with some risk factors in adult population aged 20-70 years in Mosul City, to get some information on root surface caries in order to focus attention on an important dental problem that is likely to become more significant in

future.

## MATERIALS AND METHODS

The study was conducted in Mosul City, which is subdivided into urban and rural areas.

A random sample of 231 subjects was collected, 115 from an urban and 116 from a rural areas. Urban sample consisted of 73 males and 42 females and rural sample consisted of 71 males and 45 females; all aged from 20 to 69 years old. Each sample group was divided into five age groups: 20-29, 30-39, 40-49, 50-59, and 60-69 years.

The questionnaire forms were completed by the dentist which include name, age, sex, medical condition and use of medication, saliva condition (flow) and area of residency.

Intraoral examination was carried out using plane mouth mirror, sickle—shaped explorers and periodontal probes. All subjects were examined while seated in a dental chair. Each person was examined for root surface caries, pocket depth and tooth missing. Root caries examination criteria described by Banting *et al.*<sup>(24)</sup> for identification of root caries which are:

Score 1: A discrete well—defined and discoloured soft area.

Score 2: An explorer enters easily and displays some resistance.

Score 3: The lesion is located either in the cement—enamel junction or wholly on the root surface.

Radiographs were not taken for any of the participants because of practical limitations.

Root caries index (RCI) was calculated for each subject according to Katz<sup>(25)</sup> as follows:

$$RCI = \frac{(R-D) + (R-F)}{(R-D) + (R-F) + (R-N)} \times 100$$

Where: R-D: Recession with decayed root surface

R-F: Recession with filled root surface

R-N: Recession with sound root sur-

face

Gingival recession was recorded as present if at least 0.5 mm of root surface was visible.

Further classification of decayed surface was recorded according to severity by Billings et al. (26):

- Grade I: Incipient.
- Grade II: Shallow
- Grade III: Cavitation
- Grade IV: Pulpal involvement.

The depth of the pocket was scored for each tooth in the sextant from the four surfaces (buccal or labial, lingual or palatal, mesial and distal) and the one with greatest depth was recorded only. (27)

The extent of loss of attachment was recorded using the following codes according to World Health Organization: (27)

- 0: Loss of attachment of 0-3 mm (cemento-enamel junction not visible).
- 1: Loss of attachment of 4-5 mm (cemento-enamel junction within the black band).
- 2: Loss of attachment 6-8 mm (cemento-enamel junction between the upper limit

of the black band and the 8.5 mm ring).

3: Loss of attachment 9-11 mm (cemento-enamel junction between the 8.5 mm and 11.5 mm rings).

4: Loss of attachment 12 mm or more (cemento-enamel junction beyond the 11.5 mm ring).

Analysis of the data included percentage, calculation of means, Student's t-test, chi-square test and analysis of variance (ANOVA) at  $p \leq 0.05$ .

### RESULT

Distribution of the sample by age, gender and side were shown in Table (1). The sample consisted of 231 subjects, divided into 5 age groups with 10 years interval (20-70 years old). In urban area, the proportion of males (31.6) was much higher than that of females (18.2). also, the proportion of males in rural area (30.7) was much higher than females (19.5).

Table (1): Distribution of studied sample according to site, gender and age.

Age (Years)	Urban				Rural				Total			
	Male		Female		Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>20-29</b>	14	19.2	10	23.8	13	18.3	5	11.1	27	18.8	15	17.2
<b>30-39</b>	10	13.7	6	14.3	10	14.1	9	20.0	20	13.9	15	17.2
<b>40-49</b>	19	26.0	8	19.0	9	12.7	6	13.3	28	19.4	14	16.1
<b>50-59</b>	13	17.8	7	16.7	28	39.4	9	20.0	41	28.5	16	18.4
<b>60-69</b>	17	23.3	11	26.2	11	15.5	16	35.6	28	19.4	27	31.1
<b>Total</b>	73	31.6	42	18.2	71	30.7	45	19.5	144	62.3	87	37.7

Table (2) showed that the prevalence of root surface caries (RSC) in the age group (20-29) years was 5.97 and the prevalence increased with the increase of age to reach the highest mean (28.01) in the

age group (60-69) years. No significant difference occurred between urban and rural area in all age groups except in 30-39 years old.

Table (2): Mean of root caries index with age between urban and rural regions.

Age Group (Years)	Urban			Rural			Total		
	No.	Mean	± SD	No.	Mean	± SD	No.	Mean	± SD
<b>20-29</b>	24	3.34a	9.92	18	9.47 ab	14.56	42	5.97 a	1.91
<b>30-39*</b>	16	13.78 ab	18.05	19	2.36 a	4.07	35	7.58 a	2.30
<b>40-49</b>	27	25.11 bc	23.34	15	16.22 bc	16.12	42	21.94b	3.28
<b>50-59</b>	20	19.16 bc	21.15	37	25.73 cd	22.93	57	23.43b	2.96
<b>60-69</b>	28	27.83 c	23.43	27	28.18 d	14.86	55	28.01b	2.63
<b>Total</b>	11	18.62	21.79	11	18.72	19.37	231	18.67	1.35
	5			6					

Mean of root surface caries with gender was shown in Table (3). In urban area for the total sample, RCI was similar in males and females (18.62 and 18.6 1,

respectively), while in rural area the RCI was higher in females (20.91) than in males (17.33) and the differences were statistically insignificant

Table (3): Mean of root caries index with gender between rural and urban areas.

Gender	Urban			Rural			Total		
	No.	Mean	± SD	No.	Mean	± SD	No.	Mean	± SD
<b>Males</b>	73	18.62	21.54	71	17.33	19.27	144	17.99	1.70
<b>Females</b>	42	18.61	22.49	45	20.91	19.55	87	19.81	2.24
<b>Total</b>	115	18.62	21.79	116	18.72	19.37	231	18.67	1.35

Significant difference existed between rural and urban areas ( $p \leq 0.05$ ).

The severity of root caries is shown in Table (4). Grade I had the greatest percentage irrespective of the age group with percentage of 42.6% for urban and 41.4% for rural areas, followed orderly by grade

II (23.5% for urban and 30.2% for rural areas), then grade III (22.6% for urban and 23.3% for rural areas), and finally grade IV (11.3% for urban and 5.1% for rural areas).

Table (4): Number and percentage of sample according to the severity of root caries by age group.

Site	Age (Years)	G1		G2		G3		G4		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%
		Urban	20-29	22	91.6	2	8.3	0	0.0	0	0.0
30-39	7		43.8	8	50.0	1	6.3	0	0.0	16	100
40-49	7		25.9	5	18.5	11	40.7	4	14.8	27	100
50-59	5		25.0	6	30.0	8	40.0	1	5.0	20	100
60-69	8		28.6	6	21.4	6	21.4	8	28.6	28	100
Total	37		42.6	27	23.5	26	22.6	13	11.3	115	100
Rural	20-29	17	94.4	1	5.6	0	0.0	0	0.0	18	100
	30-39	16	84.2	3	15.8	0	0.0	0	0.0	19	100
	40-49	5	33.4	8	53.3	2	13.3	0	0.0	15	100
	50-59	10	27.0	14	37.8	10	27.0	3	8.1	37	100
	60-69	0	0.0	9	33.3	15	55.6	3	11.1	27	100
	Total	48	41.4	35	30.2	27	23.3	6	5.1	116	100

Chi –square test between urban and rural areas for the total age group:  $\chi^2 = 3.906$ ,  $df = 4$ ,  $p = 0.419$  (Not significant).

Table (5) demonstrated the mean number of missing teeth for both subjects from urban and rural areas. The mean

number of the missing teeth increased with the increase of age for all subjects affected by root surface caries.

Table (5): Relationship between root surface caries index and missing teeth according to age and gender.

Age Group (Years)	Male		Female		Total	
	Mean	± SD	Mean	± SD	Mean	± SD
	20-29	0.66	0.83	1.73	1.70	1.04
30-39	1.65	1.59	1.46	1.59	1.57	1.57
40-49	1.89	2.43	2.57	2.02	2.11	2.33
50-59	4.24	4.76	6.31	3.87	4.82	4.59
60-69	7.10	4.85	7.11	3.34	7.10	4.14
Total	3.31	4.19	4.33	3.71	3.69	4.04

*Root caries among adult population*

Table (6) and Figure (1) showed the relation of root surface caries to missing teeth. There was a significant difference

between 30-39 and 60-69 years age groups only between urban and rural areas.

Table (6): Relation between rural and urban subjects with root caries index and missing teeth.

Age Group (Years)	Urban			Rural			Total		
	No.	Mean	SE	No.	Mean	SE	No.	Mean	SE
20-29	24	1.33 a	0.29	18	0.66 a	0.22	42	1.04 a	0.20
30-39*	16	2.50 a	0.43	19	0.78 a	0.19	35	1.57 a	0.66
40-49	27	1.77 a	0.48	15	2.73 ab	0.48	42	2.11 a	0.36
50-59	20	5.45 b	1.02	37	4.48 b	0.76	57	4.82 b	0.60
60-69*	28	5.85 b	0.83	27	8.40 c	0.66	55	7.10 c	0.55
Total	115	3.41	0.35	116	3.94	0.39	231	3.69	0.26

Significant difference existed between rural and urban areas ( $p \leq 0.05$ ), Means with different letters vertically were statistically significant ( $p \leq 0.05$ ).

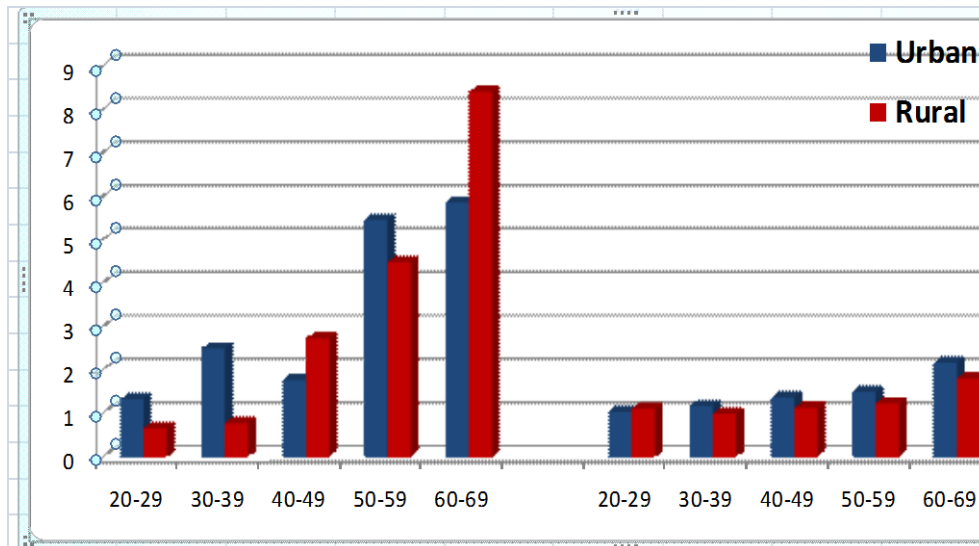


Figure (1): Relation between rural and urban subjects with root caries index and missing teeth and pocket depth.

The findings of this study revealed that the higher percentage of subjects with root surface caries in urban and rural areas was

67.8% and 76.7%, respectively; and their pocket depth was 0-3 as shown in Table (7).

Table (7): Number and percentage of subjects from rural and urban areas with root caries in relation to the pocket depth.

Root Caries Index with Pocket	Site				Total	
	urban		Rural		No.	%
	No.	%	No.	%		
< 3	78	67.8	89	76.7	167	72.3
4 - 5	30	26.1	25	21.6	55	23.8
6 - 8	6	5.2	2	1.7	8	3.5
9 - 11	1	0.9	0	0.0	1	0.4
> 12	0	0.0	0	0.0	0	0.0
Total	115	100	116	100	231	100

Chi -square test:  $\chi^2 = 4.175$ ,  $df = 3$ ,  $p = 0.243$  (Not significant).

Table (8) and Figure (1) showed the mean pocket depth in relation to root surface caries. There was no significant dif-

ference between urban and rural areas among all age groups except 30-39 years age group.

Table (8): Relationship between rural and urban subjects with root caries index and pocket depth.

Age Group (Years)	Urban			Rural			Total		
	No.	Mean	± SD	No.	Mean	± SD	No.	Mean	± SD
20-29	24	1.04 a	0.20	18	1.11 a	0.32	42	1.07 a	0.26
30-39*	16	1.18 a	0.40	19	1.00 a	0.00	35	1.08 a	0.28
40-49	27	1.37 a	0.62	15	1.13 a	0.35	42	1.28 a	0.55
50-59	20	1.50 a	0.51	37	1.24 a	0.49	57	1.33 a	0.51
60-69	28	2.17 b	1.96	27	1.81 b	0.96	55	2.00 b	1.50
Total	115	1.49	1.11	116	1.30	0.63	231	1.39	0.91

Significant difference existed between rural and urban areas ( $p \leq 0.05$ ). Means with different letters vertically were statistically significant ( $p \leq 0.05$ ) using Duncan's Multiple Range Test.

Table (9) showed the relation of root surface caries with some risk factors. The mean of subject with root surface caries who has systemic

disease was higher for both rural and urban areas (23.20 and 29.60, respectively) than that without systemic disease (17.36 and 16.58, respectively). There was a significant difference in urban region only at  $p \leq 0.05$ .

The same results were shown for subjects with root surface caries who take medication chronically for rural and urban regions (21.64 and 32.28, respectively) than that of those without medication intake (17.99 and 16.41, respectively). The

difference was significant in urban region at  $p \leq 0.05$ .

Also, the mean of smokers with root surface caries was higher for both regions (20.54 and 24.13, respectively) than the mean of those without smoking (18.02 and 15.68, respectively). The difference was significant in urban area only at  $p \leq 0.05$ .

The mean of subjects with root surface caries who complain from decreased salivary flow (dry mouth) was higher for both rural and urban areas (24.98 and 26.65, respectively) than the mean of those with normal salivary flow (16.82 and 16.27, respectively). The difference was significant in urban region only at  $p \leq 0.05$ .

Table (9): Relation between rural and urban subjects with root caries index and risk factors.

Risk Factor	Urban			Rural			Total			
	No.	Mean	± SD	No.	Mean	± SD	No.	Mean	± SD	
Disease	With	18	29.60	19.48	27	23.20	16.29	45	25.76	17.71
	Without	97	16.58	21.68	89	17.36	20.10	186	16.95	20.88
Student's t -test		t= 2.375, df = 113 P= 0.019(S)			t= 1.378, df = 114 P= 0.171(NS)					
Drug	With	16	32.28	23.82	23	21.64	15.53	39	26.91	19.79
	Without	99	16.41	20.74	93	17.99	20.22	192	17.18	20.45
Student's t -test		t= 2.780, df = 113 P= 0.006(S)			t= 0.807, df = 114 P= 0.421(NS)					
Smoking	With	40	24.13	19.96	32	20.54	19.17	72	22.54	19.56
	Without	75	15.68	22.28	84	18.02	19.52	159	16.92	20.83
Student's t -test		t= 2.007, df = 113 P= 0.047(S)			t= 0.625, df = 114 P= 0.533(NS)					
Saliva	Normal	89	16.27	21.47	89	16.82	19.42	178	16.55	20.41
	Hypo.	26	26.65	21.37	27	24.98	18.18	53	25.80	19.64
Student's t -test		t= 2.169, df = 113 P= 0.032(S)			t= 1.939, df = 114 P= 0.055(NS)					

S: Significant difference ( $p \leq 0.05$ ); NS: No significant difference ( $p > 0.05$ ).

Table (10) showed that in the total sample the percentage of root surface caries severity in both urban and rural areas was increased from grade I to III, then decreased with grade IV with subject having medical disease, medication intake,

hyposalivary flow and smoker subjects but decreased from grade I to IV with medically fit, without medication intake, normal salivary flow, and non smoker subjects.

Table (10): Relationship between severity of root surface caries in rural and urban areas and risk factors

Risk Factor	Severity	Urban				Rural			
		No		Yes		No		Yes	
		No.	%	No.	%	No.	%	No.	%
Disease	Grade I	48	49.5	1	5.6	44	49.4	4	14.8
	Grade II	21	21.6	6	33.3	27	30.3	8	29.6
	Grade III	19	19.6	7	38.9	15	16.9	12	44.4
	Grade IV	9	9.3	4	22.2	3	3.4	3	11.2
Drug	Grade I	48	48.5	1	6.3	45	48.4	3	13.0
	Grade II	22	22.2	5	31.2	28	30.1	7	30.5
	Grade III	20	20.2	6	37.5	17	18.3	10	43.5
	Grade IV	9	9.1	4	25.0	3	3.2	3	13.0
Smoking	Grade I	42	56.0	7	17.5	38	45.2	9	28.2
	Grade II	15	20.0	12	30.0	23	27.4	10	31.2
	Grade III	11	14.7	15	37.5	18	21.4	12	37.5
	Grade IV	7	9.3	6	15.0	5	6.0	1	3.1
Saliva	Grade I	44	49.4	5	19.2	46	51.7	2	7.5
	Grade II	18	20.2	8	30.8	24	26.9	11	40.7
	Grade III	16	18.0	11	42.3	16	18.0	11	40.7
	Grade IV	11	12.4	2	7.7	3	3.4	3	11.1

### DISCUSSION

Root surface caries has been and continued to be a major problem for dentate elderly adults. As such management of root caries in older population is predicted to be one of the greatest challenges facing dental team in the future.<sup>(28)</sup>

From the findings of this study, the distribution of the study sample according to age and gender as shown in Table (1), which illustrated that the percentage of males in all age groups was higher than that of females. This result was in agreement with other studies in Mosul City.<sup>(28, 29)</sup> This may be due to the fact that females look after their teeth better than males.

In general, the mean root surface caries obtained in this study for both urban and rural regions was higher than that reported by AlSayagh<sup>(28)</sup> in Mosul City (6.34). This could be due in part to variation in sampling method, sample size, sex distribution and the criteria used in finding

caries.

The study revealed that RCI rate tend to be increased with age. This confirmed the findings of other studies.<sup>(29,30)</sup> This may be attributed to the fact that the older subjects have been exposed longer time to risk factors, thus their tendency for root caries occurrence will be greater.

Regarding gender difference, in urban area RCI was similar in males and females, while in rural area females have higher RCI (20.91) than males (17.33). It is possible that this observation is related to the number of natural teeth remaining and to the oral hygiene and extent and severity of periodontal disease which also has been shown to vary between the genders.

The findings of the present study relating to caries severity shown

in Table (4) revealed that according to Billings et al. classification<sup>(26)</sup>, that for both genders grade I reported the highest percentage followed by grade II, then

grade III and finally grade IV reported the least percentage. This finding agreed with the result obtained in other studies,<sup>(31, 32)</sup> but disagreed with the result obtained in other studies.<sup>(28,33)</sup> As the individual become older, grades II, III and IV increased with age in both genders which may be attributed to the irreversibility of root caries and its progressiveness.

Grade IV of root caries exhibited the lower percentage than other grades for all age groups. This may be attributed to the fact that most of persons affected with root surface cars are never seeking treatment of their root surface caries, and after pulp involvement which is a painful condition, they extract their tooth.

As shown in Table (5), the mean number of missing teeth in relation with age increased, the cause might be due to that younger people may be more aware of their dentition status than older ones. In addition to that periodontal disease are reported to be increasing with age. (34-36)

The result from Table (7) showed that the higher percentage of subjects with root surface caries recorded pocket depth 0-3 mm. this finding was in agreement with the findings reported by other researchers.<sup>(28, 37)</sup>

The findings of this study were in agreement with Al—Sayagh study<sup>(28)</sup> in that subjects with pocket have more root caries index as shown in Table (8) and Figure (1). This may be because pocket formation occur as a result of recession of gingiva and denudation of the root surface.

According to this study, Table (9) showed that subjects with root surface caries reported higher mean with subjects taking medication chronically than that reported for those have not use medication with significant difference at  $p \leq 0.05$  in urban region. These findings were in agreement with other studies.<sup>(13, 28, 38)</sup> So, many of these drugs as a side effect can cause hyposalivation and impair oral defense and as end result, more chances for root surface caries.

Medical condition may influence the oral environment of the patient and increase the risk of root caries. So, the findings of this study showed that subjects with medical condition have higher mean of root surface caries in both rural and ur-

ban areas than that of medically fit subjects. The differences were significant at  $p \leq 0.05$  for urban but not significant in rural regions. This was in agreement with other studies.<sup>(28,38)</sup>

This study concluded that subjects with root surface caries which have decrease in salivary flow reported increase in mean of root caries in both rural and urban regions than that with subjects having normal salivary flow. The differences were significant at  $p \leq 0.05$  in urban but not significant in rural regions.

Saliva is extremely important as a protective agent against root caries because of its ability to buffer and dilute intraoral acid and to assist the removal of food debris and microorganisms from tooth surface. Deficiency of saliva severely compromises an essential defense mechanism.<sup>(38)</sup>

Smoking may also changes the physiologic condition of the oral cavity and therefore increase the risk of root surface caries. As shown in the results of this study, subjects with smoking have higher root surface caries mean for both rural and urban regions than that of non smoker subjects. The differences were significant in urban region at  $p \leq 0.05$  but not significant in rural region.

The significant differences in urban region may be due to the evidence that root surface caries occurs frequently in less developed societies due to lack of social support network and less education in this region.

Table (10) showed that the severity percentage of root surface caries was increased in subjects with medical disease, medication use, smoker subjects and hyposalivary flow subjects but decreased in medically fit, no medication use, non smokers and normal salivary flow subjects. This may be attributed to the fact that root caries lesion is initiated on a root surface exposed to the oral environment which physiologically affected by these factors. The decrease in grade IV percentage in subjects with medical disease, medication intake, hyposalivary flow and smoker subjects may be attributed to teeth extraction due to pain.

Finally, the prevalence of data of root surface caries indicated that the sample was considered as high risk group to root



caries, especially those with old age. The adult population in this study need a preventive and curative programs which include dental health education to stimulate individuals to adopt proper oral hygiene habits. This may prevent the progression of periodontal disease and prevent root caries. Also, the use of different types of topical application of fluoride as fluoridated mouth rinses, fluoride dentifrices and fluoride gel to arrest the root caries. In addition, there is a high need for dental treatment for those with very high percentages of root caries.

### CONCLUSIONS

The results of the present study showed that the root surface caries is regarded to be high in both rural and urban population, especially elderly people. For this reason the adult population need a preventive and curative programs which include dental health education and use of different types of fluoride. In addition there is a high need for dental treatment for those with very high percentages of root caries.

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