

Research Article

Tooth wear in relation to physical salivary characteristics among gastroesophageal reflux disease

Marwa Siddik Abdulrazak^{1*}, Alhan Ahmed Qasim², Ali Ismael Falih³

1. Master student. Department of Pedodontics and Preventive Dentistry. College of Dentistry. University of Baghdad. Baghdad-Iraq.

2. Assistant Professor. Department of Pedodontics and Preventive Dentistry. College of Dentistry. University of Baghdad. Baghdad-Iraq.

3. Gastroenterologist at Iraqi health ministry. Arabic Board in Gastroenterology and Hepatology, Baghdad-Iraq.

*Correspondence :email, marwa.siddik92@gmail.com

Received date: 14-03-2022

Accepted date: 21-04-2022

Published date: 15-06-2023



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<https://doi.org/10.26477/jbcd.v35i2.3392>

Abstract: Background: Gastroesophageal reflux disease, is a quite prevalent gastrointestinal disease, among which gastric content (excluding the air) returns into the oral cavity. Many Oral manifestations related to this disease include tooth wear, dental caries also changes in salivary flow rate and pH. This study was conducted among gastroesophageal reflux disease patients in order to assess tooth wear in relation to salivary flow rate and pH among these patients and the effect of gastroesophageal reflux disease duration on this relation. Materials and methods: One hundred patients participate in this cross-sectional study for both genders and having an age range of 20-40 years old, patients had been endoscopically identified as having gastroesophageal reflux disease using the classification of Los Angeles (LA), who were attending the Gastroenterology and Hepatology Teaching Hospital in Baghdad. and divided into two groups: group A with grade severity mucosal breakage not longer than 5 mm and Group B with grade severity mucosal breakage more than 5 mm long, Smith and Knight (1984) tooth wear index criteria were used for the assessment of tooth wear. For measurement of salivary flow rate and pH, saliva sample (unstimulated) had been collected. Results: Of the entire sample (90%) were having tooth wear. Tooth wear was higher in grade B severity than in grade A severity among patients with gastroesophageal reflux disease duration of two years or less, while it was higher in grade A than in grade B among patients with a duration of more than two years but all these results were statistically non-significant. Salivary flow rate and pH showed a non-significant reduction with increasing gastroesophageal reflux disease severity for both of groups concerning disease duration. The correlation of total tooth wear with salivary flow rate and pH was a significantly weak negative correlation in grade A, while a nonsignificant weak negative correlation in grade B. Conclusions: The findings of the present study concluded that patients with gastroesophageal reflux disease recorded a high occurrence of tooth wear and there was a negative correlation of tooth wear with salivary flow rate and pH among patients with gastroesophageal reflux disease.

Keywords: gastroesophageal reflux disease, GERD, tooth wear, salivary flow rate, pH.

Introduction

Diagnosing many systemic diseases by observation of their oral manifestation possibly makes the dentist the primary health care professional to diagnose such diseases. Gastroesophageal reflux disease (GERD) could be one of such disease, which could be evidenced by the observation of an unexplained presence of tooth wear (dental erosion) ^(1,2). The return of stomach contents other than air to the esophagus is known as gastroesophageal reflux. The term "gastroesophageal reflux disease" (GERD) refers to reflux that causes a variety of symptoms and, or damages or impairs the mucosa of the esophagus or neighboring upper aerodigestive system organs and occasionally the lower respiratory tract⁽³⁾.

The effects of gastroesophageal reflux disease are not just restricted to the esophagus, but have also frequently been linked to several extra-esophageal involvements ⁽⁴⁾. Heartburn, regurgitation and Dysphagia represent the classical GERD symptoms ^(5,6). In contrast, extra-esophageal symptoms of GERD might include a broad spectrum of illnesses such as nocardiac chest pain, posterior laryngitis, chronic coughing, recurrent pneumonitis, asthma, tooth erosion, and sleeping disorder ⁽⁷⁾. Dental erosion, dental caries, halitosis, a burning sensation, xerostomia, and erythemia of the uvula and palatal mucosae could be the most frequent oral manifestations of GERD ⁽⁸⁾. Long durations of gastroesophageal reflux disease have been related to an elevated risk of GERD physical complications which could include local esophageal complications, extraesophageal complications, asthma and even esophageal adenocarcinoma ⁽⁹⁾.

Tooth wear, also known as tooth surface loss, represent the pathological tooth tissue loss caused by a disease process differs from dental caries ^(10,11). It occurs as a result of the three processes (attrition, abrasion, and erosion) interaction that can occur, each one alone or in combination ⁽¹²⁾. Tooth wear etiology is mostly multifactorial as a result of local, systemic, mechanical, biological, chemical and \ or tribological factors ⁽¹³⁻¹⁵⁾. Evidence suggests that tooth wear is a frequently reported extra-oesophageal symptom of GERD ⁽¹⁶⁾.

Saliva can be defined as the biologically produced, watery secretions of the salivary glands found in both human and animal oral cavities ⁽¹⁷⁾. Several functions were served by human saliva including moistening and lubrication, digestion, taste and smell, wound healing factors, protection of the oral and esophageal mucosa and tooth protection ⁽¹⁸⁾. Multiple studies found that there was a significant association between GERD, reduction in salivary flow rate and the subjective "dry mouth" sensation (xerostomia) ^(19,20). When compared with controls, Salivary flow rate and pH were found to be lowered among GERD patients ⁽²¹⁾.

As soon as there was no previous Iraqi study on the effect of GERD on oral health, this study was conducted in order to assess tooth wear in relation to salivary flow rate and pH among those patients, the null hypotheses was that there is no relationship between the occurrence of tooth wear and reduced salivary flow rate and pH in patients that having gastroesophageal reflux disease.

Materials and Methods

After receiving official approval from the College of Dentistry- University of Baghdad's Research Ethics Committee, this cross-sectional study was conducted. It was carried out during the period from the end of March 2021 until the end of September 2021. A pre-study consent form was assigned to all the patients who participated in this study. 100 subjects with gastroesophageal reflux disease (GERD), including both genders and with an age range of 20 to 40 years old, make up the study sample. According to the Los Angeles (LA) classification, which divides GERD into 4 grades depending on the severity and extent of mucosal breakage, the patients were classified by the specialist (a gastroenterologist) as having any grade of GERD (labeled A through D). the first grade is (A) which denotes one or more mucosal breakage that their length are not exceeding 5 mm and not continuous between the peaks of two or more mucosal folds, the second grade is (B) that denotes there is one or more breakage and their length is more than 5 mm and not continuous between the peaks of two or more mucosal folds, and the third grade is (C) which denotes that breakages are continuous between the peaks of two or more mucosal folds but less than 75% of the circumference of esophageal mucosa will be involved, and the last grade is (D) which

denotes that the involvement of at least 75% of esophageal circumference may be affected by mucosal breakage⁽⁹⁾. During the study, only patients with grades A and B (54 patients (54%) and 46 patients (46%), respectively, met the inclusion and exclusion criteria for this study were found. All patients who attend Baghdad's Gastroenterology and Hepatology Teaching Hospital who had been diagnosed as having gastroesophageal reflux disease by the use of endoscopy were included but had no prior history of any other systemic diseases.

Exclusion criteria: Any patient who has another kind of systemic disease including diabetes, respiratory infection, cardiovascular disease, metabolic syndrome, patients wearing appliances, patients who are smokers, and patients receiving medication for any other disease.

Smith and Knight (1984) tooth wear index criteria were used to examine and record the surfaces of all teeth⁽²²⁾, using a plain mouth mirror and light-emitting diode (LED) headlight for illumination. The collection of unstimulated saliva was accomplished by passive drooling of saliva in graduated test tubes for five minutes, this was accomplished as directed by the University of Southern California School of Dentistry⁽²³⁾. Previous to the starting of saliva samples collection, it should be confirmed by the patients that in the last hour, excluding water, they did not drink or eat anything. After washing the oral cavity with distilled (deionized) water, the patient was instructed to rest in a relaxed position for (5) minutes in previous to the beginning of collection process. During this procedure movement should be minimized, particularly the movement of the mouth. The patient is then told to swallow in order to clear the mouth of saliva while beginning the process with a slight mouth opening to allow saliva to dribble into the graded tube and with a forward inclination of the head. the last step, when the five minutes ended, the patients were instructed to gather all of the mouth's leftover saliva and expectorate it inside the tube, and this step should be achieved as fast as possible. The flow rate was then determined by dividing the milliliters (ml) of the entire saliva collected by the minute (min) it took to collect the saliva⁽²⁴⁾.

Salivary pH has been measured by using a digital pH meter by immersing it in the tube of the saliva sample, then waiting for about thirty seconds in order to have a stable reading and record the result. The pH meter was calibrated every day by using two pH solutions (pH=4.01, pH=7.01) as recommended by manufacturer instruction, then washing and disinfecting the head of the pH meter by washing it with running distilled water and then alcohol disinfectant was used and finally dried with filter paper.

The statistical analysis was completed with the Statistical Package for Social Science (SPSS version -22, Chicago, Illinois, USA). Using descriptive analysis which includes mean, standard error, and a cluster chart bar. Inferential analysis was used as an independent sample T-test parametric test to determine the difference between the two groups. The Pearson correlation parametric test was used to determine if two quantitative variables were linearly related.

Results

From the whole sample (90%) was recorded tooth wear. Regarding GERD severity, the prevalence of tooth wear was found to be higher among grade B(mucosal breakage longer than 5 mm) GERD severity than grade A(mucosal breakage not longer than 5 mm) GERD severity in different surfaces of both jaws except in lingual, mandibular buccal (Mand.B.) and mandibular cervical (Mand.cer.) surfaces as shown in figure (1).

Table (1) illustrates tooth wear according to GERD severity by disease duration. The results showed that in patients with two years or less of tooth wear the mean value of tooth wear was higher in grade B, while the mean value of tooth wear was higher in grade A in patients with a duration of more than two years without statistically significant difference, except at mandibular buccal tooth wear in patients with a duration of more than two years.

Results of salivary flow rate (SFR) and pH among GERD severity in patients with a duration of two years or less and a duration of more than two years are illustrated in Table (2). Although SFR and pH were higher in grade A than in grade B in both durations, there was no statistically significant difference.

TTW: total tooth wear, MaxTW: maxillary tooth wear, MAXOI: maxillary occlusal or incisal, MAXB: maxillary buccal, MAXCER: maxillary cervical, MANDTW: mandibular tooth wear, MANDO: mandibular occlusal, MANDB: mandibular buccal, MANDCER: mandibular cervical.

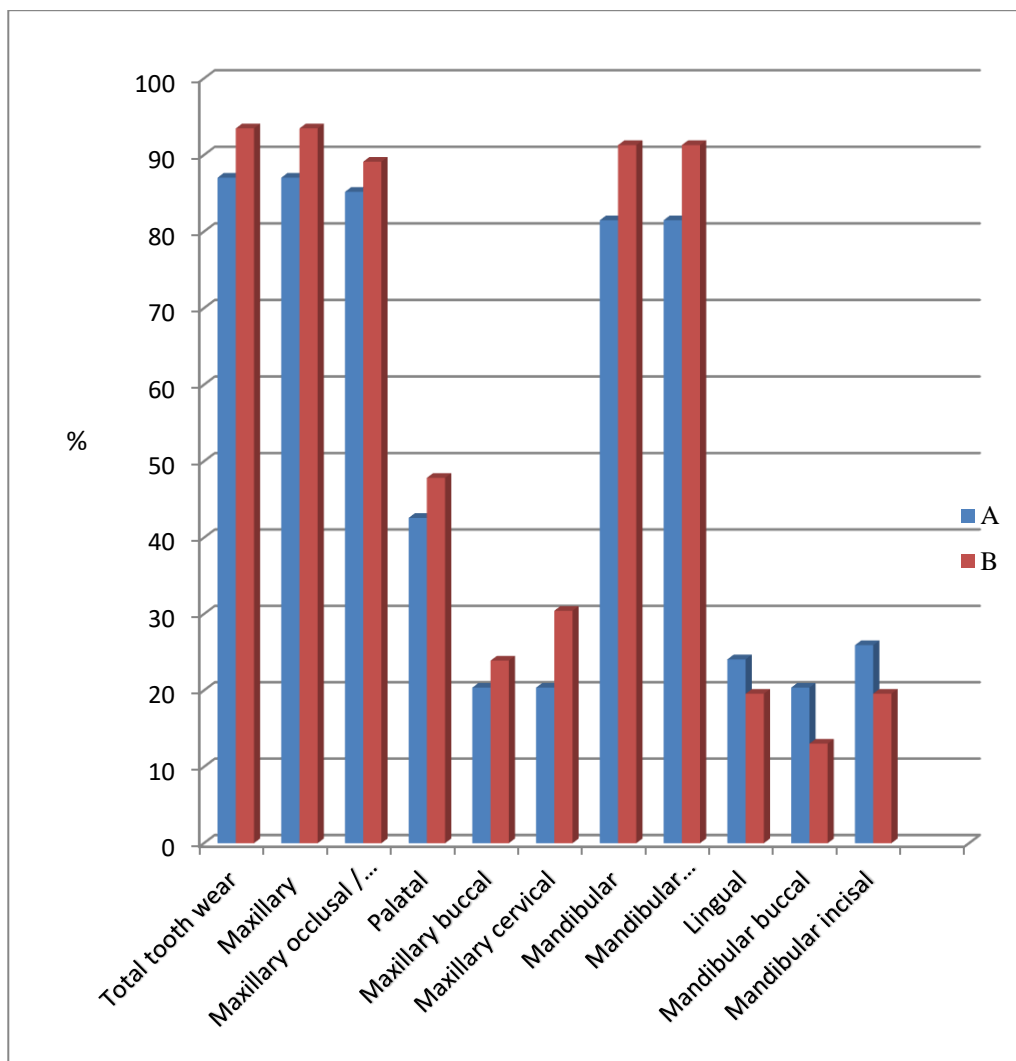


Figure 1: The percentage of patients who have tooth wear in the total sample by severity of gastroesophageal reflux disease.

A: one (or more) mucosal breakage not longer than 5 mm that does not continue between the peak of two esophageal mucosal folds.

B: one (or more) mucosal breakage more than 5 mm long that does not continue between the peak of two esophageal mucosal folds.

Table 1: Descriptive and statistical test of tooth wear among severity of gastroesophageal reflux disease by disease duration.

Duration (years)		GERD SEVERITY				T test	P value [^]
		A		B			
		MEAN	±SE	MEAN	±SE		
<=2	TTW	28.875	4.668	39.576	5.579	1.471	0.146
	MAXTW	14.344	2.317	21.545	3.003	1.899	0.062
	MAXOI	10.094	1.149	11.939	1.058	1.182	0.242
	MAXB	1.125	0.575	2.212	0.849	1.060	0.294
	PALATAL	2.094	0.647	4.394	1.023	1.900	0.063
	MAXCER	1.031	0.556	3.000	0.896	1.867	0.067
	MANDTW	14.531	2.504	18.030	2.733	0.944	0.349
	MANB	0.844	0.533	1.727	0.803	0.917	0.363
	MANDO	10.094	1.285	12.000	0.944	1.195	0.237
	LINGUAL	1.500	0.679	2.212	0.831	0.663	0.510
	MANDCER	1.781	0.750	2.091	0.836	0.276	0.784
2+	TTW	50.091	9.757	31.692	5.408	1.649	0.109
	MAXTW	26.000	4.811	17.615	3.400	1.423	0.164
	MAXOI	13.773	1.870	11.231	1.997	0.929	0.360
	MAXB	3.182	1.137	1.231	0.794	1.407	0.169
	PALATAL	5.773	1.272	3.769	1.490	1.023	0.315
	MAXCER	3.273	1.181	1.385	0.805	1.321	0.196
	MANDTW	24.091	4.996	14.077	2.704	1.763	0.088
	MANB	3.636	1.207	0.154	0.154	2.862	0.009
	MANDO	13.500	2.062	11.615	2.086	0.643	0.525
	LINGUAL	3.409	1.145	0.923	0.711	1.845	0.074
	MANDCER	3.545	1.150	1.385	0.805	1.539	0.133
Total	TTW	37.519	4.997	37.348	4.285	0.025	0.980
	MAXTW	19.093	2.493	20.435	2.354	0.387	0.699
	MAXOI	11.593	1.041	11.739	.935	0.103	0.918
	MAXB	1.963	.585	1.935	.648	0.032	0.974
	PALATAL	3.593	.684	4.217	.839	0.583	0.561
	MAXCER	1.944	.596	2.543	.686	0.663	0.509
	MANDTW	18.426	2.573	16.913	2.105	0.445	0.657
	MANDB	1.981	.608	1.283	.585	0.821	0.414
	MANDO	11.481	1.145	11.891	.885	0.276	0.783
	LINGUAL	2.278	.623	1.848	.631	0.482	0.631
	MANDCER	2.500	.650	1.891	.639	0.663	0.509

Table 2: Descriptive and statistical test of salivary Flow rate and PH among GERD severity by duration.

Duration (years)		GERD severity				T	P value
		A		B			
		Mean	±SE	Mean	±SE		
<=2	SFR	0.563	0.050	0.497	0.050	0.934	0.354
	pH	6.622	0.070	6.588	0.073	0.334	0.740
2+	SFR	0.464	0.054	0.346	0.071	1.318	0.197
	pH	6.650	0.093	6.569	0.106	0.554	0.583
Total	SFR	0.522	0.037	0.454	0.042	1.221	0.225
	pH	6.633	0.056	6.582	0.060	0.620	0.537

SFR: salivary flow rate pH: salivary pH

Results in table (3) show that Tooth wear's correlations with pH and SFR are not significant weak correlations in the severity of group B GERD, while significant negative weak correlations with SFR in group A GERD severity, while in pH with group A, A non-significant negative weak correlations are found in palatal, max. and mand. Cerv., and mand. BW.

Table 3: correlations of tooth wear with salivary flow rate and pH in GERD severity.

Vars.	SFR				PH			
	GERD severity				GERD severity			
	A		B		A		B	
	r	p value	r	p value	r	p value	R	p value
TTW	-0.369*	0.006	-0.210	0.161	-0.379*	0.005	-0.153	0.309
MAXTW	-0.363*	0.007	-0.182	0.225	-0.380*	0.005	-0.184	0.220
MAXOI	-0.278*	0.042	0.060	0.692	-0.419*	0.002	-0.222	0.138
MAXB	-0.287*	0.036	-0.204	0.173	-0.308*	0.024	-0.147	0.330
Palatal	-0.410*	0.002	-0.213	0.155	-0.260	0.058	0.040	0.789
MAXCER	-0.280*	0.041	-0.254	0.088	-0.259	0.059	-0.240	0.108
MANDTW	-0.366*	0.007	-0.224	0.134	-0.368*	0.006	-0.106	0.481
MANDO	-0.303*	0.026	-0.033	0.827	-0.414*	0.002	-0.146	0.333
MANDB	-0.328*	0.016	-0.186	0.215	-0.183	0.185	0.008	0.957
Lingual	-0.292*	0.032	-0.263	0.078	-0.285*	0.037	-0.073	0.631
MANDCER	-0.266*	0.052	-0.263	0.077	-0.239	0.082	-0.084	0.579

*=significant at p<0.05, TTW: total tooth wear, MaxTW: maxillary tooth wear,

MAXOI: maxillary occlusal or incisal, MAXB: maxillary buccal, MAXCER: maxillary cervical

MANDTW: mandibular tooth wear, MANDO: mandibular occlusal, MANDB: mandibular buccal

MANDCER: mandibular cervical.

Discussion

In spite of symptomatic GERD becoming a common condition in our population and chronic duration of the disease have been recognized among GERD patients⁽²⁵⁾, there are no previous reports in the literature on the oral findings among GERD patients in Iraq. Considering the upper gastrointestinal (GI) endoscopy as the gold standard for GERD confirmation⁽²⁶⁾ for this reason the included patients in this study were those who had been diagnosed as having GERD by the use of upper GI endoscopy. The patients were diagnosed and classified according to the Los Angeles (LA) classification⁽⁹⁾.

There is strong evidence linking changes in the oral cavity to alterations in systemic health^(27,28). Due to the fact that the oral cavity is a component of the digestive system, gastrointestinal illnesses may appear as oral disorders⁽²⁹⁾. In this study a high frequency of tooth wear was found in this study (90%) These results were similar to those found in previous studies (18, 30-33) who reported a significant association between tooth wear and GERD. Unlike the results of Jensdottir and colleagues who reported a low prevalence of dental erosion among GERD patients⁽³⁴⁾.

Results of this study concerning GERD duration found that patients with tooth wear were higher in grade B than in grade A among patients with a duration of two years or less, while tooth wear was higher in grade A than grade B among patients with longer duration (more than two years), this could be explained by that GERD patients did not tend to cross over from one grade to another in a follow-up periods range from (6) months to longer than (22) years^(35,36).

In this study, salivary flow rate and salivary pH were higher in grade A than in grade B although without statistically significant differences, but these results agree with the results found by Preetha et al.⁽³⁷⁾ who found that there was an inverse relationship between salivary flow rate and pH and GERD severity grade. Furthermore, Tooth wear's correlation with salivary pH and salivary flow rate is a negative correlation in both grade A and B severity which agree with Agbor et al.⁽³⁸⁾ and this could be due to the reduction of salivary flow rate among GERD patients⁽³³⁾ as long as saliva is considered to be the main defense mechanism from acid exposure present in the oral cavity so any change in the amount and quality of saliva will affect its defensive roll by acid clearance and neutralization⁽³⁹⁾. While lowered pH of the oral cavity due to acid reflux could lead to the dissolution of the inorganic material of the teeth (dissolution of hydroxyapatite crystals in the tooth enamel), and then to dental erosion making the teeth to be predisposed to friction (wear of the tooth)⁽⁴⁰⁾.

Conclusion

From the present study, it could be concluded that a high incidence of tooth wear could be noticed among GERD patients and this would be related to salivary flow rate and pH reduction among GERD patients. GERD patients need to regularly visit a dentist to get proper preventive programs and a dentists physicians cooperation is very important to prevent or reduce further oral effects of GERD.

Conflict of interest: None.

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العنوان: تآكل الأسنان فيما يتعلق بخصائص اللعاب الفيزيائية بين مرض الارتجاع المعدي المريئي

الباحثون: مروة صديق عبد الرزاق , أمان أحمد قاسم , علي إسماعيل فالح

المستخلص:

الخلفية: مرض الارتجاع المعدي المريئي ، وهو مرض منتشر جدا في الجهاز الهضمي ، والذي يمكن أن يحدث فيه عودة محتوى المعدة بخلاف الهواء إلى الفم. العديد من المظاهر الفموية المرتبطة بهذا المرض بما في ذلك تآكل الأسنان وتسوس الأسنان والتغيرات في معدل تدفق اللعاب ودرجة الحموضة. أجريت هذه الدراسة على مرضى الارتجاع المعدي المريئي من أجل تقييم تآكل الأسنان فيما يتعلق بمعدل تدفق اللعاب ودرجة الحموضة بين هؤلاء المرضى وتأثير مدة مرض الارتجاع المعدي المريئي على هذه العلاقة. المواد والطرق: شارك مائة مريض في هذه الدراسة المقطعية ، وكانوا يترددون على المستشفى التعليمي لأمراض الجهاز الهضمي والكبد في بغداد والذين تم تشخيصهم بالمنظار بمرض الارتجاع المعدي المريئي وفقاً لتصنيف لوس أنجلوس (LA) ، والذين تتراوح أعمارهم بين 20-40 عاماً وكلا الجنسين. تم استخدام معايير مؤشر تآكل الأسنان (Smith and Knight (1984) لتقييم تآكل الأسنان. تم جمع عينات اللعاب غير المحفزة لتقدير معدل تدفق اللعاب ودرجة الحموضة. النتائج: من العينة بأكملها (90%) كان لديهم تآكل في الأسنان. كان تآكل الأسنان أعلى في شدة الدرجة B (كسر الغشاء المخاطي بطول أكثر من 5 مم) منه في شدة الدرجة A (كسر الغشاء المخاطي لا يزيد عن 5 مم) بين المرضى الذين يعانون من ارتجاع المريء لمدة عامين أو أقل ، في حين أنه كانت أعلى في الدرجة A مما كانت عليه في الدرجة B بين المرضى الذين تزيد مدتهم عن عامين ولكن كل هذه النتائج كانت غير معنوية إحصائياً. أظهر معدل تدفق اللعاب ودرجة الحموضة انخفاضاً طفيفاً مع زيادة شدة مرض الارتجاع المريئي لكلا المجموعتين فيما يتعلق بمدى المرض. كان الارتباط بين تآكل الأسنان الكلي ومعدل تدفق اللعاب ودرجة الحموضة ارتباطاً سلبياً ضعيفاً بشكل ملحوظ في الدرجة A بينما الارتباط السلبي الضعيف غير المعنوي في الدرجة B. الاستنتاجات: خلصت نتائج الدراسة الحالية إلى أن مرضى الارتجاع المعدي المريئي سجلوا ارتفاعاً تآكل الأسنان وكان هناك ارتباط سلبي لتآكل الأسنان مع معدل تدفق اللعاب ودرجة الحموضة بين مرضى الارتجاع المعدي المريئي.