Original Research

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Factors associated with dental erosions in gastroesophageal reflux disease: a cross-sectional study in patients with heartburn

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Abstract

Background and aim. Dental erosion (DE) represents a frequent condition in adults and the elderly. The gastroesophageal reflux disease (GERD) is considered an important endogenous factor causing dental erosions. The objective of this study was to assess the prevalence of DE in GERD patients and to establish the correlation between pathogenic intrinsic and extrinsic factors of DE and their relation to GERD.

Methods. A cross-sectional study was conducted on 263 patients (median age 43). Patients with heartburn were recruited in two countries with different prevalence of GERD. Patients were recruited from France (n=158, 60%) and Romania (n=105, 40%) including 163 females and 100 males. The Basic Erosive Wear Examination (BEWE) index for diagnosis and evaluation of dental erosion was used. Based on the value of BEWE score, each patient was included in a risk group for DE development (low risk: BEWE=3-8, medium risk: BEWE=9-13, high risk: BEWE ≥14). Patients filled a questionnaire regarding GERD symptoms, medications, life style. Salivary parameters (pH and buffering capacity) were also assessed and analyzed.

Results. DE was significantly more frequent and more severe in GERD subjects than in the non-GERD controls. Low salivary pH but not salivary buffering capacity was associated with BEWE scores. Buffering capacity however was significantly more altered in patients with BEWE score over 9 (medium DE) than in patients with mild DE (BEWE <9). Although extrinsic factors (consumption of citrus fruits, soda drinks) were associated with DE in GERD, there was no statistical correlation with the BEWE score. From the total of 263 patients, 229 (87.1%) presented BEWE score <9, and 34 (12.9%) presented BEWE ≥9. The DE was significantly associated with the presence of GERD ($p<0.001$). BEWE score >9 was more frequently present in GERD patients (30 patients: 21.3%) than in non GERD patients (4 patients: 3.3%). DE were more frequent in French subjects compared to Romanian subjects. Romanians had lower BEWE scores than the French.

Conclusions. DE is more frequent and more severe with GERD vs. non-GERD. DE in GERD is associated with extrinsic dietary factors like citrus fruits and soda drinks.

Keywords: tooth wear, gastroesophageal reflux, heartburn

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Introduction

Dental erosion (DE) is a progressive dental tissue loss that implies a chemical process induced by acid exposure, without bacterial involvement [1,2]. Intrinsic factors, i.e. vomiting, regurgitation, gastroesophageal reflux disease (GERD), bulimia, anorexia nervosa and extrinsic factors, i.e. diet, work environment, swimming in pools and some drugs changing oral acidity and salivary clearance are involved in the etiology and pathogenesis of DE [2-8]. DE represents a mechanism of tooth wear [4] and has a high prevalence in adults: 7.7% on the facial surface of young people (26-30 years) and

twice as high in older people (46-50 years; occlusal erosions are encountered in 30% of younger people and in 43% of older people [8].

Dental tissues are softened by the erosion mechanisms and become more vulnerable to mechanical stress, thus DE may be confounded with dental abrasion or attrition [4].

Although DE (Figure 1a and 1b), is recognized as being associated to GERD [9], few data are published on its determinants in GERD patients. Differences may exist due to diet or lifestyle particularities in different countries [10-12]. There is a need to investigate the prevalence of DE in GERD and the factors correlated to this association.

Figure 1a. Severe dental erosion associated to GERD and extrinsic factors in a 44 years old male.

Figure 1b. Aesthetic disorders due to DE in same patient.

As first objective, we looked for the prevalence of DE in GERD and for intrinsic and extrinsic factors related with DE. We looked also for the association of GERD and DE and for the differences between patients in two countries: France, where GERD is common and severe forms are encountered [13] and in Romania, where GERD is usually less severe and less common [14].

Methods

This study was conducted in three tertiary centers, two in France (University Hospital Center Nantes and University Hospital Bordeaux) and one in Romania (Iuliu Hatieganu University of Medicine and Pharmacy County Hospital, Cluj-Napoca).

A prospective, cross-sectional study was carried out using a special questionnaire developed and applied in this study and representing a modification of the GerdQ form. The questionnaire included 36 items distributed in two parts. The first part included, besides biographical data, items addressing the following factors: presence of a previous diagnosis of GERD; associated diseases or history of: bruxism, asthma, chronic cough, GERD, dyspepsia, head or neck radiotherapy, dry mouth (sicca syndrome), eating disorders (bulimia, anorexia); diet habits (consumption of acidic food); use of carbohydrate and energizing drinks; life-style: use of mouthwash considered a protective factor [15], frequent swimming in pool (for water ingestion); professional: possibility of inhalation of corrosive substances; medication (aspirin, antacid, antiasthmatic). The second part of the questionnaire included questions on several gastrointestinal and extradigestive symptoms and their intensity (evaluated by subjects from 0 to 4=maximum): heartburn, regurgitation, dysphagia, upper abdominal discomfort, nausea, chronic vomiting, cough, sleep disorders. This questionnaire was adapted after GerdQ [16]. We collected information on BMI. The questionnaire forms were filled during an interview taken by trained investigators.

Oral clinical examinations were performed in all subjects and DE was evaluated by the BEWE Index (Basic Erosive Wear Examination) [17]. All the teeth were examined on buccal (B), palatal (P)/lingual (L) and occlusal (O)/ incisal (I) surfaces and the biggest score in each sextant was noted. Final score was obtained by summing all values from sextants; it was used to appreciate the risk for DE development in every patient. Dental examination was conducted by trained investigators (AB, AP, AMC).

The BEWE score quantifies the DE severity as follows: 0-3: none; 4-8: low; 9-13: medium; >13: high [3].

Analysis of pH and buffer capacity of the saliva was also performed and was recorded using specific salivary tests (GC Salivary kit) [18].

We examined 443 subjects, presenting either for chronic heartburn (the group of GERD patients), or referred to dental checkup (not for dental therapy) and otherwise healthy (the non-GERD control group). The GERD and the control groups were recruited in consecutive order.

From these we retained for the study only the subjects corresponding to the inclusion criteria. Inclusion criteria for the GERD group were: given informed consent, existence of a previous GERD diagnosis, based on the medical history of the patient, and confirmed by a previous or current endoscopy and pH-monitoring and/ or pH-impedance testing; at least one natural tooth in

every sectant (in order to evaluate DE by BEWE score). Exclusion criteria for the GERD group were: patients with missing teeth or with prosthesis (fixed or removable), making impossible BEWE score evaluation.

Inclusion criteria for the non-GERD control group were: given informed consent, patients without GERD or any other digestive disease, referred to dental checkup. Exclusion criteria for the control group were: history of symptoms of gastrointestinal disorders.

All data were analyzed using statistic SPSS version 21 software. Continuous variables were tested for normality by the Kolmogorov-Smirnov test. Continuous data were characterized by median and 25 and 75 percentiles; nominal variables were characterized by frequency and percents. Continuous variables were compared by Mann-Whitney test. Comparison of nominal variables was performed by chi^2 test. P value <0.05 was considered statistically relevant.

Approval was obtained from the local ethics committee of all participating medical centers. Written informed consent was obtained from each participating patient.

Results

From the 443 subjects recruited in consecutive order, a number of 180 subjects (97 from the GERD group, 83 from the non-GERD group) were excluded from the study because they presented prosthesis or missing teeth, not allowing a correct evaluation of DE by BEWE score.

Therefore, 263 subjects were retained for this study. They were recruited in two separate groups: GERD patients (n=141, 53.6% of all subjects) and non-GERD controls (n=122, 46.4%).

The majority were females 163 (62%) and 100 (38%) were males.

The distribution of subjects according to age decades is displayed in Figure 2.

GERD presented a prevalence variation according to age decades. The GERD group was significantly older than the non-GERD group: median age in GERD group was 47 (35.5-59) and in the non-GERD group of 34.5 (25.7-54).

In order to assess the occurrence of DE in GERD, we compared the group with absent DE having BEWE≤3 with the group having DE present, with BEWE>3. Prevalence of DE in GERD (92.9%) was significantly higher than in controls (72.1%) (chi square=20.27, p<0.001).

The prevalence of DE according to BEWE score is presented in Table I.

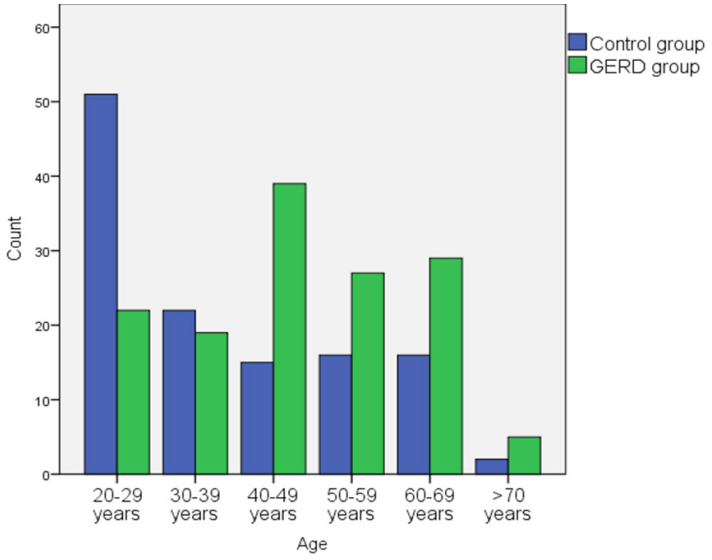

Figure 2. Age distribution of GERD and non GERD patients according to age decades.

Table I. The prevalence of DE according to BEWE score in GERD and non GERD patients (≤3: absent; 4-8: low; 9-13: medium and >13: high).

	≤3	4-8	9-13	>13
GERD	10 (22.7%)	101 (54.6%)	30 (88.2%)	0
Non-GERD	34 (77.3%)	84 (45.4%)	4 (11.8%)	0
		P<0.001		

Non-GERD subjects presented more frequently absence of DE; low DE score was also more frequent in the Non-GERD group; medium erosion was significantly higher in GERD than in the non-GERD group; no subject presented severe DE.

As expected, there was a correlation between salivary acidity expressed by salivary pH and DE expressed by BEWE score (Figure 3). Salivary pH was significantly different between GERD and non-GERD patients ($p<0.05$). For GERD patients, pH varied between 5.8 and 6.4 with median 6.1. For non-GERD patients pH varies between 6.4 to 6.8 with median 6.6.

Buffering capacity of saliva was not correlated with BEWE score.

The BEWE score < 9 was strongly associated with a higher salivary pH: pH=6.4 (CI: 6-6.6) ($p=0.012$); in cases with score BEWE ≥9, the mean salivary pH was lower: pH=6.05 (CI 5.8-6.4)

We looked for the prevalence of factors associated with DE in GERD and non-GERD subjects. They are displayed in Table II.

Surprisingly, bruxism was not encountered as a risk factor, neither was the use of mouthwash. But we observed a significantly higher prevalence of DE in GERD compared to non-GERD regarding the consumption of citrus fruits and carbohydrate drinks. Use of antacid drugs was more frequent in GERD than in controls with DEs.

Our samples did not include cases with bulimia and anorexia, chronic vomiting, alcoholism, history of radiotherapy.

We analyzed further the factors associated with DE in GERD according to the severity of DE expressed by BEWE score. Since no case had severe DE, we classified the subjects into a group with mild DE (BEWE <9) and a group with medium DE (BEWE score ≥9).

From the total of 263 subjects, 229 (87.1%) presented BEWE score <9, and 34 (12.9%) presented BEWE ≥9. It means that in our subjects, DE in GERD is more frequently mild and rarely more severe.

There was no significant difference between the BEWE score in both genders ($p=0.871$).

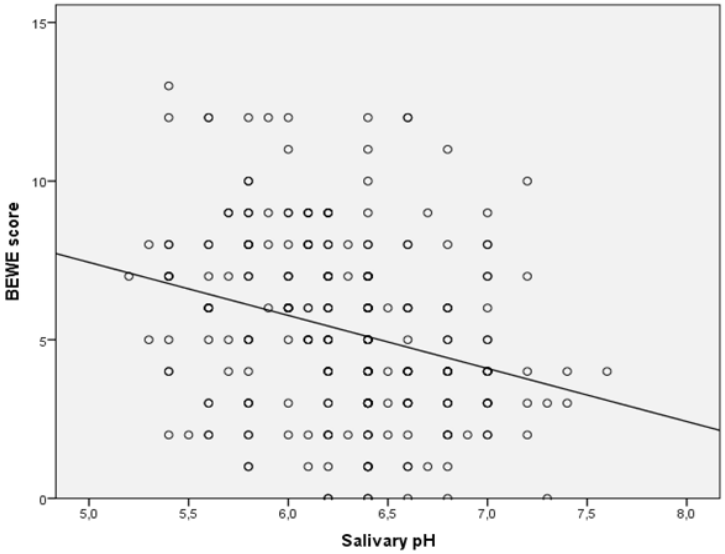

Figure 3. Correlation curve between salivary pH and DE BEWE score.

Table II. The prevalence of intrinsic and extrinsic risk factors for DE.

	GERD (n. %)	Control (n, %)	P
Bruxism	58.8	41.2	0.166
Antacid drugs	75	25	0.000
Carbohydrate drinks>3/week	60.2	39.8	0.021
Acid fruits (citrus) >3/week	57.6	42.4	0.018
Mouthwash	54.8	45.2	0.407

Table III. The relationship between DE determinants and severity of BEWE score.

Variable		BEWE <9	BEWE ≥9	P
Age (years)		35 (25; 57)	45 (35; 56)	0.002
Sex	Male	44 (44%)	56 (56%)	1
	Female	71 (43.6%)	92 (56.4%)	
Intrinsic factors	GERD	25 (17.7%)	116 (82.3%)	<0.001
Extrinsic factors	Acidic drinks	55 (41.4%)	78 (58.6%)	0.5
	Citric fruits	83 (41.9%)	115 (58.1%)	0.3
Bruxism		30 (37.5%)	50 (62.5%)	0.2
Salivary buffering capacity		8 (7; 9)	8 (6; 9)	<0.001
Salivary pH		6.4 (6.2; 6.8)	6.1 (5.8; 6.4)	0.03

The relationship between DE determinants and BEWE score is displayed in Table III.

Although extrinsic factors were associated with DE in GERD, there was no statistical correlation with the BEWE score. Buffering capacity however was significantly lower in BEWE score over 9 (medium DE) than in mild DE (BEWE <9).

We also looked for the association between age and GERD symptoms, and the Spearman correlation coefficient was r=0.27, thus presenting a trend but not a statistical significance. Similarly, the correlation coefficient between DE measured by BEWE score and the GERD symptoms showed the same behavior, with r=0.26, given the risk to develop DE with ageing.

A secondary analysis looked for potential differences between French and Romanian GERD subjects, given some differences in life style. From the 263 participants, 158 subjects were French (60% from all subjects, including 88 GERD and 70 non-GERD) and 105 were Romanian (40%, including 53 GERD and 52 non-GERD). GERD was present in 88 of 158 French subjects (56%) and in 53 of 105 Romanian subjects (50%). In the GERD group, the French subjects were more numerous (62.4%) than the Romanians (37.6%).

The severity of DE was also higher in French than in Romanians. Thus, in French, 57 (36.1%) subjects had mild DE expressed by BEWE <9, and 101 (63.9%) had severe DE with BEWE score >9 vs. Romanians with mild DE was encountered in 58 subjects (55.2%) and severe in 47 cases (44.8%) (p<0.003).

Our data show that DE was more frequent in French subjects compared to Romanian subjects. Romanians have lower BEWE scores than French.

Regarding nationality, French subjects, having more frequently GERD, reported larger consumption of citrus fruits than Romanians 82% vs. 65% (p=0.02). French subjects used less acidic drinks than Romanians 46% vs. 57%, but the difference was not significant.

Discussion

DE is common in GERD and represents an important extradigestive complication of GERD, of relevance for oral health. Despite difficulties in diagnosing DE [19], this association is well recognized [20,21]. Prevalence data differ according to geographical area, population investigated, age of subjects, etc. Changes of the teeth are observed in children and also in adults. In a previous study, Farahmand et al. [22] found DE in 98% in children with GERD, while in another study by Jarvinen et al. [23] DE was detected in 6.4% of patients with upper digestive symptoms. Another paper reported DE in 26% of GERD patients [11]. Our study reported a high prevalence of DE in GERD but also in controls, with a very significant differences between the two groups.

Our study reports data consistent with previous knowledge on the association of lifestyle factors and DE [3]. In our patients, the use of acid fruit or drinks was associated with DE. The use of antacid, as GERD patients do, had a protective effect against DE.

Mouthwash consumption was included in the questionnaire due to the positive influence on tooth protection related to biguanides action (polyhexamethylene biguanide – PHMB and chlorhexidine – CHX) on the enzymatic degradation of the demineralized organic matrix. In our study, DE risk for patients using mouthwash was not statistically lower than in patients who did not use mouthwash (p=0.839).

Lower pH values in GERD patients compared with a control group, confirm the higher risk for DE in this condition.

Our data showing higher prevalence of DE in GERD are important for preventive measures. Dental examination should be introduced in the investigation protocol of every GERD patient in the gastroenterology services. Thus, incipient dental lesions can be diagnosed in early stages, avoiding irreversible tooth loss and laborious prosthetic rehabilitation. Advanced stages

need complex prosthetic treatment and multidisciplinary approach [24-27]. It has even been proposed to screen for GERD symptoms all patients who present to oral health providers [28]. A longitudinal survey of GERD patients for progression of dental erosions is recommended [29].

The screening should be carried out not only in patients with histologically proven esophagitis, but in all those who present symptoms of GERD, mainly heartburn. In a recent study the DE did not correlate with the presence of histologically proven esophagitis, i.e. patients with non-erosive reflux disease are also able to develop DE [30].

Given the worldwide distribution of this association [31,32] the education of oral health providers should be amplified in order to better detect DE in GERD symptoms, with or without esophagitis.

The present study is a cross-cultural study on Romanian and French patients, looking for the prevalence of DE in GERD and for the factors correlated with DE. Our data show that the prevalence of GERD is similar in Romanian and French subjects, although in the French it is non-significantly higher. DE in GERD was more frequent and more severe in French subjects.

The difference in prevalence of GERD between French and Romanian patients could depend on lifestyle, but it was not significant on our sample. However DE erosions were more severe in French subjects, and this difference should be related not only to GERD. Citrus fruit consumption could also contribute to DE in the French population, same as acid soda drinks in Romanians.

Clinicians should be aware of the predisposing risk factors for GERD and its esophageal and extraesophageal symptoms and signs. The impact of GERD for the healthcare providers is important [33]. Aesthetic issues are also linked with DE [34].

For GERD patients, a specific prophylactic and therapeutic protocol is needed in dental reconstructions. Dental erosion is rarely diagnosed in early stages and dental tissue loss usually progresses slowly. Therefore the patient education about GERD prevention needs to be improved.

Our study comprises also some limitations. Thus, larger samples and longer observation periods would increase the power of our study. However, the data are reliable, presenting new data on DE in GERD. It brings new evidence on the association of DE with GERD, whose mechanism is not yet fully understood [35].

The effect of age is of major importance in the discrimination of the effect of GERD from the effect of time exposure in patients with DE. In our patients, the GERD group was older than the controls. However, we do not think that this difference was able to introduce a bias. Indeed, one can differentiate the DE caused by age from the DE caused by GERD from the clinical appearance of erosions. The erosion in older subjects is associated with abrasion and attrition. The edge of attrition and abrasion is sharper than in DE were the edge is round [36]. In our study we recognized the DE caused by GERD and analyzed them, avoiding to analyze the abrasion or attrition injuries.

Conclusions

DE in GERD is a common finding. Life-style may be important in the occurrence of DE in GERD. DE, but not severity, assessed by BEWE score is associated with consumption of citrus fruits and soda drinks.

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References

1. Lussi A, Portmann P, Burhop B. Erosion on abraded dental hard tissues by acid lozenges: an in situ study. Clin Oral Investig. 1997;1:191-194.
2. Lussi A, Jäggi T, Schärer S. The influence of different factors on in vitro enamel erosion. Caries Res. 1993;27:387-393.
3. Lussi A, Jaeggi T. Erosion--diagnosis and risk factors. Clin Oral Investig. 2008;12 Suppl 1:S5-S13.
4. D'Incau E, Saulue P. Understanding dental wear. J Dent Anomalies and Orthodontics, 2013; 15:104-123.
5. Lussi A, Jaeggi T, Zero D. The role of diet in the aetiology of dental erosion. Caries Res. 2004; 38 Suppl 1:34-44.
6. Lussi A, Hellwig E. Erosive potential of oral care products. Caries Res. 2001;35 Suppl 1:52-56.
7. Parry J, Shaw L, Arnaud MJ, Smith MJ. Investigation of mineral waters and soft drinks in relation to dental erosion. J Oral Rehabil. 2001;28:766-772.
8. Lussi A, Schaffner M, Hotz P, Suter P. Dental erosion in a population of Swiss adults. Community Dent Oral Epidemiol. 1991;19:286-290.
9. Milosevic A. Gastro-oesophageal reflux and dental erosion. Evid Based Dent. 2008;9:54.
10. Dent J, El-Serag HB, Wallander MA, Johansson S. Epidemiology of gastro-oesophageal reflux disease: a systematic review. Gut. 2005;54:710-717.
11. Meurman JH, Toskala J, Nuutinen P, Klemetti E. Oral and dental manifestations in gastroesophageal reflux disease. Oral Surg Oral Med Oral Pathol. 1994;78:583-589.
12. Dundar A, Sengun A. Dental approach to erosive tooth wear in gastroesophageal reflux disease. Afr Health Sci. 2014;14:481-486.
13. Bruley des Varannes S, Löfman HG, Karlsson M, Wahlqvist P, Ruth M, Furstnau ML, et al. Cost and burden of gastroesophageal reflux disease among patients with persistent symptoms despite proton pump inhibitor therapy: an observational study in France. BMC Gastroenterol. 2013;13:39.

14. Diculescu M, Iacob R, Chira C, Mihăilă D, Iacob S. Esomeprazole in the treatment of patients with heartburn and other upper gastrointestinal symptoms, referred to primary care - results of the in-practice evaluation program in Romania. Rom J Gastroenterol. 2005;14:9-14.
15. Amaechi BT, Higham SM, Edgar WM. The influence of xylitol and fluoride on dental erosion in vitro. Arch Oral Biol. 1998;43:157-161.
16. Jones R, Junghard O, Dent J, Vakil N, Halling K, Wernersson B, et al. Development of the GerdQ, a tool for the diagnosis and management of gastro-oesophageal reflux disease in primary care. Aliment Pharmacol Ther. 2009;3010:1030-1038.
17. Bartlett D, Ganss C, Lussi A. Basic erosive wear examination (BEWE): a new scoring system for scientific and clinical needs. Clin Oral Investig. 2008;12 Suppl 1:S65-S68.
18. Saliva testing. Good practice, good sense. GC Dental Asia Pte Ltd, Singapore: 2008. Available from: http://www.gcaustralasia.com/Upload/product/pdf/97/Brochure-Saliva-Check-BUFFER.pdf
19. Lasserre JF. Recherche sur l'usure dentaire et evaluation In Vitro de biomateriaux restaurateurs avec le simulateur d' usure UVSB2. These doct 2003: pp 23-34.
20. Pace F, Pallotta S, Tonini M, Vakil N, Bianchi Porro G. Systematic review: gastro-oesophageal reflux disease and dental lesions. Aliment Pharmacol Ther. 2008;27:1179-1186.
21. Picos AM, Poenar S, Opris A, Chira A, Bud M, Berar A, et al. Prevalence of dental erosions in GERD: a pilot study. Clujul Med. 2013;86:344-346.
22. Farahmand F, Sabbaghian M, Ghodousi S, Seddighoraee N, Abbasi M. Gastroesophageal reflux disease and tooth erosion: a cross-sectional observational study. Gut Liver. 2013;7:278-281.
23. Järvinen V, Meurman JH, Hyvärinen H, Rytömaa I, Murtomaa H. Dental erosion and upper gastrointestinal disorders. Oral Surg Oral Med Oral Pathol. 1988;65:298-303.
24. Wetselaar P, Manfredini D, Ahlberg J, Johansson A, Aarab G, Papagianni CE, et al. Associations between tooth wear and dental sleep disorders: A narrative overview. J Oral Rehabil. 2019;46:765-775.
25. Corega C, Baciut M, Vaida L, Corega MA, Baciut G. Dental white spots associated with gastro-esophageal reflux in orthodontic and orthognathic surgery patients. J Gastrointestin Liver Dis. 2009;18:497-499.
26. Bartlett DW, Evans DF, Anggiansah A, Smith BG. A study of the association between gastro-oesophageal reflux and palatal dental erosion. Br Dent J. 1996;181:125-131.
27. Gregory-Head BL, Curtis DA, Kim L, Cello J. Evaluation of dental erosion in patients with gastroesophageal reflux disease. J Prosthet Dent. 2000;83:675-680.
28. Raibrown A, Giblin LJ, Boyd LD, Perry K. Gastroesophageal Reflux Disease Symptom Screening in a Dental Setting. J Dent Hyg. 2017;91:44-48.
29. Wilder-Smith CH, Materna A, Martig L, Lussi A. Longitudinal study of gastroesophageal reflux and erosive tooth wear. BMC Gastroenterol. 2017;17:113.
30. Friesen LR, Bohaty B, Onikul R, Walker MP, Abraham C, Williams KB, et al. Is histologic esophagitis associated with dental erosion: a cross-sectional observational study? BMC Oral Health. 2017;17:116.
31. Li W, Liu J, Chen S, Wang Y, Zhang Z. Prevalence of dental erosion among people with gastroesophageal reflux disease in China. J Prosthet Dent. 2017;117:48-54.
32. Milani DC, Venturini AP, Callegari-Jacques SM, Fornari F. Gastro-oesophageal reflux disease and dental erosions in adults: influence of acidified food intake and impact on quality of life. Eur J Gastroenterol Hepatol. 2016;28:797-801.
33. Dudea D, Lasserre JF, Alb C, Culic B, Pop Ciutrila IS, Colosi H. Patients' perspective on dental aesthetics in a South-Eastern European community. J Dent. 2012;40 Suppl 1:e72-e81.
34. Bruley Des Varannes S, Marek L, Humeau B, Lecasble M, Colin R. Gastroesophageal reflux disease in primary care. Prevalence, epidemiology and quality of life of patients. Gastroenterol Clin Biol. 2006;30:364-370.
35. Pauwels A. Dental erosions and other extra-oesophageal symptoms of gastro-oesophageal reflux disease: Evidence, treatment response and areas of uncertainty. United European Gastroenterol J. 2015;3:166-170.
36. Davis WB, Winter PJ. The effect of abrasion on enamel and dentin and exposure to dietary acid. Br Dent J. 1980;148:253-256.