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Nikolaos Andreas Chrysanthakopoulos

Prevalencija i čimbenici povezani s erozijom zuba kod grčke odrasle populacije

Prevalence and Associated Factors of Dental Erosion in a Population of Greek Adults

Oralni kirurg na Maksilofacijalnoj i oralnoj kirurgiji Opće vojne bolnice u Ateni
Resident in Maxillofacial and Oral Surgery, 401 General Military Hospital of Athens, Greece

Sažetak

Svrha: U općoj ordinaciji dentalne medicine željela se odrediti prevalencija erozije zuba i istražiti povezanost mogućih čimbenika između broja oboljelih i epidemioloških pokazatelja, poput medicinskog stanja pojedinaca te prehrambenih navika i načina života. **Materijali i metode:** Uzorak se sastojao od 840 sudionika (396 muškaraca i 444 žene) u dobi od 18 do 30 godina. Svi su klinički pregledani i odgovorili su na pitanja u upitniku o njihovu medicinskom stanju, količini i učestalosti konzumacije pića i jela, stupnju obrazovanja i socijalno-ekonomskom statusu te jesu li zaposleni. Autor se koristio granicama pouzdanosti (CI) od 95 posto za procjenu jednovarijantnog odnosa među istraživanim varijablama. Statistička analiza upitnika obavljena je višestrukim logističko-regresijskim modelom. **Rezultati:** Kod 240 sudionika dijagnosticirana je erozija zuba s prevalencijom od 28,6 posto. Oboljelih muškaraca (34,3%) bilo je znatno više negoli žena (23,4%) (P=0,013). Regresijska analiza pokazala je da su najvažniji čimbenici povezani s erozijom zuba zadržavanje pića u ustima prije nego što se proguta [OR= 0,42, 95% CI= 0,13 – 0,44], povraćanje [OR= 3,12, 95% CI=1,83 – 10,24] te konzumacija voćnih sokova [OR= 2,65, 95% CI= 0,91 – 4,89] i gaziranih pića [OR=2,17, 95% CI= 1,33 – 5,62]. **Zaključak:** Rezultati dobiveni u ovom istraživanju pokazuju povezanost između erozije zuba i nekih čimbenika analiziranih u populaciji odraslih Grka, a prevalencija je iznosila 28,6 posto.

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Adresa za dopisivanje
Dr. Nikolaos Andreas Chrysanthakopoulos
35, Zaimi Street, PC 26 223,
Patra, GREECE
tel./faks: 0030 – 2610 – 225288
nikolaos_c@hotmail.com

Ključne riječi
zub, erozija; povraćanje; gazirana pića; Grčka

Uvod

Erozija zuba (DE) definira se kao lokalizirani, kronični, patološki i ireverzibilni gubitak zubnog tkiva prouzročen kiselinama ili kelacijskim otopinama, no bez utjecaja bakterija (1). Uobičajen je i čest nalaz u ordinacijama dentalne medicine, a od nje pate podjednako oba spola i sve dobne skupine. Odnosi se na tvrda zubna tkiva. Može također biti povezana s drugim nalazima, poput dentinske preosjetljivosti, karijesom korijena, abrazijom i gingivnom recesijom u slučaju izlaganja površine korijena oralnom okolišu (2, 3). S DE-om je povezano mnogo čimbenika, uključujući one kemijske i biološke, ali je važno i ponašanje pojedinaca (4 – 6). Čini se da mnogo toga uzajamno utječe na proces erozije, pa je tako vrlo teško izdvojiti rizične čimbenike. Najvažniji čimbenici povezani s nastankom erozije zuba su intrinzični i ekstrinzični, premda veliku ulogu u razvoju erozivnih lezija mogu imati i interakcije između osjetljivosti pojedinaca, kao što su svojstva sline i zuba/zubnih tkiva (4, 6, 7). Intrinzični čimbenici uključuju bolesti koje uzrokuju povraćanje ili regurgitaciju, te bolesti koje smanjuju protok sline (7 – 9), a u ekstrinzične se ubrajaju prehrambene navike (kiseli napici i hrana) (5, 9, 10), okolišni čimbenici (rad u *kiseloj* radnoj – industrij-

Introduction

Dental erosion (DE) has been defined as a result of a localized, chronic, pathologic and irreversible loss of hard dental tissue caused by acids or chelants without bacterial involvement (1). This has been considered a common condition that is frequently encountered in dental practice, affecting both genders of all ages and describing the condition of hard dental tissue. This may also be associated with other conditions, such as dentine hypersensitivity, root caries, abrasion and gingival recession in case of the exposure of the root surface to the oral environment (2,3). A large number of factors has been identified as significantly associated with DE including chemical, biological and behavioral factors (4-6). These factors seem to influence the erosive process, making it difficult to identify the risk factors. The most important factors that have been associated with DE are intrinsic and extrinsic, however, interactions between individuals' susceptibility factors, such as salivary characteristics and tooth/tissue anatomy may play an important role in the development of erosive lesions (4, 6, 7). The intrinsic factors include diseases that cause vomiting or regurgitation, such as gastro-esophageal reflux, anorexia and bulimia nervosa, or illnesses that

skoj okolini punoj klora) i sportovi (plivanje u jako kloriranim bazenima (/8, 9, 11), lijekovi (kiseli pripravci ili oni koji uzrokuju smanjen protok sline) (4, 8, 9, 11) i navike (gutanje i pijenje, konzumacija kiselih pića prije spavanja) (5, 8, 9). Na eroziju zuba dodatno utječu i stupanj obrazovanja te kulturološki i zemljopisni čimbenici (12). Očito je da je etiologija DE-a mnogostruka i uvijek je rezultat zajedničkog djelovanja nekoliko čimbenika.

Iako su u nekoliko zemalja autori mnogih epidemioloških studija proučavali sve navedeno u razvoju erozivnih lezija kod odraslih, u Grčkoj sličnih istraživanja nije bilo. Zato je važno skupiti detaljne podatke o eroziji zuba kako bi se procijenio trend i dobili epidemiološki podaci, identificirali etiološki čimbenici i odredile preventivne mjere. Ovo presječno istraživanje provedeno je na uzorku odrasle populacije u Grčkoj zbog procjene prevalencije DE-a i moguće povezanosti između prehrambenih navika, medicinskog stanja pojedinaca, načina života i erozije zuba.

Ispitanici i postupci

Uzorak se sastojao od 840 pojedinaca – 396 muškaraca i 444 žene u dobi od 18 do 30 godina. Grčko Ministarstvo zdravstva i Komora dentalne medicine svake godine organiziraju preglede za školsku djecu i odrasle kako bi se procijenila prevalencija bolesti poput karijesa i parodontitisa, stupanj oralne higijene i potreba za terapijskim zahvatima u populaciji. Tada svi sudionici popunjavaju zdravstveni upitnik i odlaze na oralni klinički pregled u nekoliko općih ordinacija ili u određene privatne ordinacije dentalne medicine. Taj preduvjet koji zahtijeva Grčka komora dentalne medicine vrlo je važan poticaj kako bi se stvorio reprezentativni nasumični uzorak. Skupljeni podaci dostavljaju se Komori dentalne medicine na epidemiološku analizu. U sklopu spomenute akcije Nacionalnog odbora za oralno zdravlje ovo istraživanje provedeno je od listopada 2011. do ožujka 2012. godine. Važno je istaknuti da ono nije bilo navedeno kao tema u studiji te institucije, pa su zato sudionici popunjavali dodatni upitnik i na stomatološki pregled išli u privatnu ordinaciju dentalne medicine. Istraživani uzorak podijeljen je u dvije skupine – u prvoj su bili sudionici s erozivnim promjenama (EPG) na najmanje jednoj zubnoj površini, a u drugoj oni bez erozija (EAG) i znakova erozivnih promjena na zubima. Kriteriji za sudjelovanje u istraživanju bili su dob od 18 do 30 godina, te prosječno 20 vlastitih zuba jer bi mnogo izgubljenih zuba moglo poremetiti rezultate istraživanja. Više od 12 izvađenih zuba može prouzročiti teškoće s prehranom, govorom i drugim osnovnim aktivnostima i one se tijekom godina mogu pogoršati. To može uzrokovati i druge bolesti, uključujući parodontne (patološka migracija i pomičnost zuba), sindrom temporomandibularnog zgloba, karijes i ostale, te može rezultirati uveličavanjem i podbacivanjem prognoza o prevalenciji DE-a i njezinih čimbenika koji se proučavaju. To je

cause a reduction in saliva flow (7-9) while the extrinsic ones include dietary habits (acidic drinks and foods) (5,9,10), occupational factors (occupation around acidic/chlorinated industrial environment) and sports (swimming in heavily chlorinated pools) (8,9,11), medicaments (acidic drugs or drugs that cause reduction in salivary flow) (4,8,9,11) and lifestyle habits (swallowing and drinking habits, consumption of acidic beverage at bedtime) (5,8,9). In addition, DE is influenced by educational, cultural and geographical factors (12). It is obvious that the etiology of DE is multi-factorial and is always the result of more than one factor acting together.

Despite the fact that a great number of epidemiological studies have investigated the role of the mentioned factors in the development of erosive lesions in adults in several countries, similar studies have not been carried out in Greece; therefore, it is important to collect detailed information of this condition in order to assess the tendency and epidemiology of this condition, identification of the etiological factors and to establish preventive measures. The current cross-sectional study was carried out in order to estimate the prevalence of DE and to determine possible correlations between dietary habits, individuals' medical condition, lifestyle factors and DE in an adult population sample in Greece.

Materials and methods

Subject population consisted of 840 individuals, 396 males and 444 females, 18 to 30 years of age. The Greek Ministry of Health and the Greek Dental Association organize dental surveys for schoolchildren and adults annually, in order to assess the prevalence of diseases such as dental caries and periodontitis, the oral hygiene level and the treatment needs of the Greek population. All the participants complete an oral health questionnaire and undergo an oral clinical examination in several general or specific private dental practices free of charge. This precondition determined by the Greek Dental Association is an important motivation to create a representative random sample. The collected data from the practices will be sent to the Greek Dental Association in order to perform an epidemiological analysis. As part of the mentioned National Oral Health Survey, the present study was carried out between October 2011 and March 2012. It is important to highlight that the topic of the present investigation was not included in the National Oral Health Survey. Therefore, the participants of the present study completed an additional questionnaire and underwent an oral clinical examination in a private practice. Study population was divided into two groups: erosion presence group (EPG) which showed erosion in at least one tooth surface and erosion absence group (EAG) which did not show any type of erosive lesion. The selection criteria of the participants comprised age above 18 and up to 30 and a mean number of 20 natural teeth since large numbers of missing teeth might interfere with the results of the study. More than 12 missing teeth can cause problems with eating, speech, and other basic activities that may worsen with time. That situation can cause other oral diseases, including periodontal disease (pathologic migration, mobility), temporomandibular joint disorder, dental

razlog da su iz istraživanja bile isključene osobe s ortodontskim napravama, defektom cakline i gubitkom zubnog tkiva, s frakturiranim ili izvađenim zubima, te ako im je kamenac ili protetska restauracija (ispun/krunica) prekrivala cementno-caklinsku granicu, posebice kod maksilarnih sjekutića ili kod prvog maksilarnog ili mandibularnog trajnog kutnjaka.

Klinički pregled

Klinički pregled obavljen je u privatnoj ordinaciji dentalne medicine na standardnom stolcu osvijetljenom reflektorom. Sudionike je pregledao iskusan liječnik. Pregledi su uključivali procjenu labijalnih i palatinalnih površina maksilarnih trajnih sjekutića (#11,12,21,22) te okluzalne površine prvih trajnih kutnjaka (# 16,26,36,46). Koristio se validiranim indeksom prema O'Brienu (13). Kako bi se procijenila prevalencija DE-a, promatrane su samo caklinske površine sa širokim i plitkim lezijama u U-obliku s glatkim površinama i bez jasnih granica (1). Tijekom pregleda zubi i desni nježno su posušeni komprimiranim zrakom kako bi liječnik mogao pozorno pregledati navedene površine ne bi li uočio erozivne lezije.

Upitnik

Nakon kliničkih pregleda svi su sudionici anonimno popunili upitnik sastavljen tako da se mogu uočiti etiološki čimbenici povezani s DE-om. Sadržavao je varijable poput dobi i spola, tražili su se podaci o općem medicinskom stanju uz naglasak na lijekove i kronične poremećaje, pića i jela s erozivnim potencijalom te koliko se često unose u organizam, što je klasificirano kao niska (1 do 7 puta na tjedan) i visoka (22 ili više puta na tjedan) učestalost. Pitanja o kroničnim poremećajima uključivala su želučane tegobe, dijabetes melitus, astmu i reumatoidni artritis, a lijekovi su uključivali one za astmu, aspirine, vitamin C te medikamente koji smanjuju protok sline (primjerice, atropin-hidroklorid i ostali). U upitniku su bila i pitanja o konzumaciji kiselih napitaka prije spavanja i zadržava li se piće u ustima prije nego što se proguta. U vezi s navikom zadržavanja pića u ustima nije bilo važno u sekundama procijeniti zadržavanje pića u ustima prije gutanja. Na kraju je postavljeno pitanje piju li se ta pića kao voda, naime ispiru li se njima usta prije nego što ih se proguta. Posljednje pitanje odnosilo se na plivanje u bazenima s kloriranom vodom ili na boravak na radnom mjestu u prostorijama s mnogo klora (tvornice klorina i sl.). Na temelju podataka iz upitnika sudionici su raspoređeni u sljedeće skupine:

– prema stupnju obrazovanja (I): nizak stupanj – primarni, (II): srednji stupanj – sekundarni, (III): viši stupanj, (IV): najviši stupanj – fakultetski
– na temelju statusa zaposlenja prema Općem registru klasifikacije radnih mjesta kojim su se koristili Bradnock i

caries, etc. and could lead to over-or underestimate the prevalence of DE and the possible associations that are under consideration. For the same reason, individuals with orthodontic appliances, enamel defect accompanied by a loss of tooth substance and fractured or missing teeth or in cases where the cement-enamel junction was covered by calculus or prosthetic restoration (filling/crown), especially regarding the maxillary incisors or the first maxillary and mandibular permanent molars were excluded from the study. Similarly, teeth with cervical carious or in cases where the cement-enamel junction was covered by calculus or prosthetic restoration (filling/crown) were also excluded from the study.

Clinical examination

The clinical examinations were performed in a private dental practice, using a conventional dental unit and illumination. One well-trained and calibrated dentist performed the examinations. The examination included the evaluation of the labial and palatal surfaces of the maxillary permanent incisors (#11,12,21,22) and the occlusal surface of the first permanent molars (# 16, 26, 36, 46) according to validated index proposed by O'Brien (13). In order to assess the prevalence of DE, only enamel was involved and erosive lesions were considered with the following clinical characteristics: wide, shallow, U-shaped lesions with a smooth surface and no clear angles (1). Initially the examined teeth and gingiva were dried with compressed air gently and the mentioned surfaces observed for erosive lesions carefully.

Questionnaire

After the oral clinical examination, all participants filled in an anonymous, self-completion questionnaire that aimed to establish the possible etiological factors which can be associated with DE. The questionnaire was self-administered and included variables such as age, gender, data regarding the general medical condition of the sample with reference to medication and chronic disorders, drink and food items which had erosive potential and the consumption of intake, which was classified as: low (1 to 7 times per week) and high consumption (22 or more times per week). Questions regarding chronic disorders included gastric disorders, diabetes mellitus, asthma, rheumatoid arthritis whereas medication included drugs for asthma treatment, aspirin, vitamin C, and drugs that cause reduction in salivary flow rate (i.e, atropine hydrochloride, etc.). The questionnaire also included questions regarding habits such as consumption of acidic drinks at bedtime and the possible habit of holding drinks in the mouth before swallowing. Regarding the habit of holding drinks in the mouth, it was not possible to estimate the period in seconds, in which the drink was kept in the mouth before swallowing. Consequently, the question was whether they consumed the examined drinks as they consumed water (rinse before swallowing). The last question concerned swimming in chlorinated pools or occupational environment in chlorinated atmosphere (chlorine factories, etc.). Based on the information provided in the questionnaire , the individuals were categorized in the following groups:

– Educational level, (I): low educated individuals - prima-

suradnici (14). Taj sustav dijeli zanimanja na šest stupnjeva: I, II, III N, III M, IV i V.

Etički aspekt

Ovo istraživanje nije eksperimentalno. Naime, u Grčkoj samo pokusna istraživanja moraju imati dopuštenje mjerodavnih povjerenstava (Stomatološkog fakulteta, Komore dentalne medicine, Ministarstva zdravstva, itd.).

Reproducibilnost

Nasumce izabrani uzorak od 168 (20%) pojedinaca jedan je liječnik dentalne medicine ponovno klinički pregledao kako bi odredio interne ispitivačke varijance. Nakon usporedbe šifriranih brojeva pacijenata nije pronađena značajna razlika između prvog i drugog pregleda *(Cohen's Kappa= 0,93)*.

Statistička analiza

Kako bi se odredila prevalencija DE-a, sudionici su postavljeni kao statistička jedinica. Statistička analiza anketa obavljena je višestrukom logističkom regresijskom raščlambom radi identifikacije varijabla koje su najbolje povezane s DE-om. Za istraživanje utjecaja rizičnih čimbenika na eroziju rabio se postupni odabir te je izabran dvostupanjski pristup. Najprije je obavljena bivarijantna analiza za testiranje odnosa između DE-a i uspoređivanih čimbenika. Zato je kriterij za neovisne varijable, da bi ušle u model, postavljen na 0,25. Dodatno je određena vjerojatnost, s granicama pouzdanosti od 95% (CI) za procjenu bivarijantne povezanosti među promatranim varijablama. Tada je navedeni model korišten za analizu čimbenika koji neovisno utječu na pojavu DE-a. Varijable su nakon analize unesene u model u progre-

ry level, (II): medium educated Individuals - secondary level, (III): upper educated individuals - college level and (IV): supreme educated individuals - university level.
– Occupation status according to the Registrar General's Classification of Occupations as used by Bradnock et al. (14). This system divides occupations into a series of six classes I, II, IIIN, IIIM, IV and V.

Ethical consideration

The present study was not an experimental one. In Greece, only experimental studies must be reviewed and approved by authorized committees (Dental Schools, Greek Dental Associations, Ministry of Health, etc.).

Reproducibility

A randomly chosen sample of 168 (20%) individuals was re-examined clinically by the same dentist in order to establish the intra-examiner variance. After consideration of the code numbers of the double examined participants, no differences were recorded between the 1st and the 2nd clinical assessment *(Cohen's Kappa= 0.93)*.

Statistical analysis

The individual was a statistical unit in order to estimate the prevalence of DE. Statistical analysis of questionnaire items was performed by using a multiple logistic regression analysis model to identify which variables were best associated with DE. A stepwise selection procedure was used to investigate the influence of risk factors on the outcome of erosion. A two-step approach was used for this purpose. First, bivariate analysis was used to test the relationship between DE and the associated factors. Thereby, the criterion for the independent variables to enter the model was set at 0.25. In addition, odds ratios with 95% confidence intervals (CI) were used to assess the bivariate relationships among the examined variables. Then, the mentioned model was used to analyze the factors that were independently related to the presence of

Tablica 1. Pitanja za upitnik u vezi s medicinskom anamnezom, prehrambenim navikama i načinom života
Table 1 A sample of questions for the questionnaire relating to medical history, dietary habits and lifestyle factors

1. Imate li teškoća sa želucem (npr. čir, gastroezfagealni refluks itd.) ili možda povraćate? • Do you have any gastric disorder (i.e. ulcer, gastro-esophageal reflux, etc.) or the symptom of vomiting?
2. Bolujete li od kakve kronične bolesti i uzimate li lijekove? (navedite koje i koliko puta na dan) • Do you have a chronic disease and take medication? (state this and the frequency of medication per day)
3. Pijete li voćne sokove? (navedite koliko puta u tjednu) • Do you drink fruit juice? (state the frequency per week)
4. Pijete li gazirana pića? (navedite koliko puta u tjednu) • Do you drink carbonated drinks? (state the frequency per week)
5. Pijete li sportske napitke? (navedite koliko puta u tjednu) • Do you drink sport drinks? (state the frequency per week)
6. Pijete li mlijeko? (navedite koliko puta u tjednu) • Do you drink milk? (state the frequency per week)
7. Konzumirate li jogurt? (navedite koliko puta u tjednu) • Do you consume yoghurt? (state the frequency per week)
8. Dodajete li ocat u hranu? (navedite koliko puta u tjednu) • Do you add vinegar to your food? (state the frequency per week)
9. Jedete li voće? (navedite koliko puta u tjednu) • Do you eat fruits? (state the frequency per week)
10. Plivate li u bazenima? • Do you swim in pools?
11. Radite li u okolišu s mnogo klorida? • Is your occupation in chlorinated environment?
12. Pijete li napitke ili voćne sokove prije spavanja? • Do you drink a beverage or fruit juice at bedtime?
13. Zadržavate li u ustima pića ili voćne sokove prije gutanja ili vam služe za ispiranje usta? • Do you hold in your mouth before swallowing or rinse your mouth with a beverage or fruit juice?

sivnom slijedu, a zatim i u regresivnom kako bi se pronašle konačne varijable koje bi se mogle smatrati rizičnim čimbenicima DE-a. Podaci su analizirani statističkim programskim paketom SPSS ver. 17,0 (SPSS Inc, Chicago, IL, SAD). Statistički značajnom smatrala se p-vrijednost manja od 5 posto (p<0,05).

Rezultati

Ukupan broj pacijenata koji je došao u ordinaciju dentalne medicine tijekom istraživanja koje je odobrila Grčka komora dentalne medicine bio je 928. Od toga broja njih 840

DE. The variables after the bivariate analysis were entered into the model in a forward process and then in a backward fashion in order to find out which final variables could be considered as risk factors of DE. The data analysis was performed using the statistical package of SPSS ver.17.0 (SPSS Inc, Chicago, IL, USA). A p value less than 5% (p<0.05) was considered to be statistically significant.

Results

The total number of the individuals who visited the private practice during the determined period by the Greek Dental Association for their annual dental follow-up was 928. How-

Tablica 2. Povezanost između spola/medicinskih čimbenika (poremećaji/lijekovi) /pića/hrane i DE-a
Table 2 Association between gender/medical factors (disorders/medication)/drinks/foods and DE

Varijable • Variables	Prisutnost erozije• Erosion presence	N (%)	Ukupan N (%) • Total N (%)	p-vrijednost • p-value	OR* 95% CI**
SPOL*** • GENDER***					
muški • Males	136 (34.3)	396 (100)	0.013	1.710	1.116-2.621
ženski • Females	104 (23.4)	444 (100)			
Anamneza • MEDICAL HISTORY					
dijabetes • Diabetes					
Da • Yes	24 (26.7)	90 (100)	0.765	0.899	0.448-1.806
Ne • No	216 (28.8)	750 (100)			
astma • Asthma					
Da • Yes	44 (21.6)	204 (100)	0.072	0.617	0.364-1.047
Ne • No	196 (30.8)	636 (100)			
želučane tegobe*** • Gastric Disorders***					
Da • Yes	82 (55.4)	148 (100)	0.000	4.199	2.490-7.081
Ne • No	158 (22.8)	692 (100)			
povraćanje*** • Vomiting***					
Da • Yes	90 (49.4)	182 (100)	0.028	1.841	1.061-3.193
Ne • No	150 (22.8)	658 (100)			
lijekovi • Medication					
Da • Yes	26 (23.2)	112 (100)	0.340	0.726	0.375-1.405
Ne • No	214 (29.4)	728 (100)			
Vitamin C					
Da • Yes	96 (27.3)	352 (100	0.617	0.896	0.582-1.378
Ne • No	144 (29.5)	488 (100)			
PIĆA • DRINKS					
voćni sokovi*** • Fruit Juice***					
mala količina • Low Consumption	84 (20.8)	404 (100	0.001	0.471	0.304-0.730
velika količina • High Consumption	156 (35.8)	436 (100)			
gazirana pića*** • Carbonated Drinks***					
mala količina • Low Consumption	52 (13.5)	384 (100)	0.000	0.223	0.137-0.365
velika količina • High Consumption	188 (41.2)	456 (100)			
sportski napici • Sport Drinks					
mala količina • Low Consumption	102 (29.5)	346 (100)	0.730	1.078	0.702-1.656
velika količina • High Consumption	138 (27.9)	494 (100)			
mlijeko • Milk					
mala količina • Low Consumption	100 (28.4)	352 (100)	0.950	0.986	0.642-1.515
velika količina • High Consumption	140 (28.7)	488 (100)			
HRANA • FOODS					
jogurt • Yoghurt					
mala količina • Low Consumption	134 (29.2)	458 (100)	0.505	1.155	0.756-1.764
velika količina • High Consumption	106 (27.7)	382 (100)			

*omjer vjerojatnosti, **granice pouzdanosti, *** test Hi-kvadrat • *Odds Ratio, **Confidence Interval, ***Chi-square test

odabrano je za sudjelovanje u istraživanju u skladu s navedenim kriterijima odabira. Kriterije nije zadovoljilo njih 55, a 33 je odbilo sudjelovati (stopa odgovora = 90,51%). Srednja dob iznosila je 24,3 ± 4,7 godina. Uzorak upitnika o medicinskom stanju, prehrambenim navikama i načinu života pojedinaca nalazi se u tablici 1. Kod 240 ispitanika dijagnosticiran je DE te je prevalencija iznosila 28,6 posto (34,3% kod muškaraca i 23,4 kod žena, uz statistički značajnu razliku u modelu bivarijantne analize – p=0,013) (tablica 2.). U uzorku je bilo 136 muškaraca s DE-om i 104 žena, pa ukupan omjer muških i ženskih ispitanika s erozijom zuba iznosi 1,31 : 1 (p=0,425). U skladu s modelom bivarijantne analize pronađena je statistički značajna razlika u prevalenciji DE-a u odnosu na želučane poremećaje, povraćanje, voćne sokove, gazirana pića i konzumaciju octa te navike da se piće zadržava u ustima prije nego što se proguta (tablica 2. i 3.). Nije pronađena statistički značajna povezanost između DE-a i dijabetesa melitusa, astme, korištenja lijekova za kroničever, 840 of them were selected to participate in the present study, according to the selection criteria mentioned above, 55 did not meet the mentioned criteria and 33 refused to participate in the study (response rate= 90.51%). The mean age of the sample of the present study was 24.3 ± 4.7 years. A sample of the questionnaire relating individuals' medical condition, dietary habits and lifestyle factors is presented in Table 1. A total of 240 patients were diagnosed with DE giving an overall prevalence of 28.6% (34.3 % in males and 23.4% in females, difference statistically significant, according to the bivariate analysis model, p= 0.013) (Table 2).One hundred and thirty six individuals with DE were males and 104 females giving an overall male to female ratio 1.31:1 (P= 0.425). According to the bivariate analysis model, there was a significant difference in the prevalence of DE in relation to gastric disorders, vomit, fruit juice, carbonated drinks and vinegar consumption and the habit of holding drinks in the mouth before swallowing (Tables 2, 3). No significant corre-

Tablica 3. Povezanost između prehrane/navika/statusa radnog mjesta/stupnja obrazovanja/socijalno-ekonomskog statusa i DE-a
Table 3 Association between foods/habits/occupational status/educational level/socio-economic status and DE

Varijable • Variables	Prisutnost erozije • Erosion presence N (%)	Ukupan N (%) • Total N (%)	p-vrijednost • p-value	OR* 95% CI**	
HRANA • FOODS					
Ocat*** • Vinegar***					
mala količina • Low Consumption	110 (21.5)	512 (100)	0.000	0.417	0.270-0.642
velika količina • High Consumption	130 (39.6)	328 (100)			
Voće • Fruits					
mala količina • Low Consumption	140 (27.5)	508 (100)	0.570	0.883	0.574-1.358
velika količina • High Consumption	100 (30.1)	332 (100)			
NAVIKE • HABITS					
Kisela pića prije spavanja • Acidic drink bedtime					
Da • Yes	50 (24.5)	204 (100)	0.297	0.762	0.457-1.271
Ne • No	190 (29.9)	636 (100)			
Zadržavanje pića u ustima*** • Hold drink in mouth***					
Da • Yes	146 (36.1)	404 (100)	0.001	2.059	1.337-3.171
Ne • No	94 (21.5)	436 (100)			
Plivanje • Swimming					
Da • Yes	40 (33.9)	118 (100)	0.329	1.338	0.745-2.406
Ne • No	200 (27.7)	722 (100)			
RAD U OKOLIŠU BOGATOM KLORIDIMAO • CCUPATION IN CHLORINATED ENVIRONMENT					
Da • Yes	36 (27.3)	132 (100)	0.799	0.926	0.514-1.669
Ne • No	204 (28.8)	708 (100)			
STUPANJ OBRAZOVANJA • EDUCATIONAL LEVEL					
osnovno • Primary	56 (26.4)	212 (100)	0.698		
srednje • Secondary	68 (28.8)	236 (100)			
više • College	64 (26.2)	194 (100)			
visoko • University	52 (26.2)	198 (100)			
SOCIJALNO-EKONOMSKI STATUS • SOCIO-ECONOMIC STATUS					
I. stupanj • I class	24 (20.7)	116 (100) 0.642			
II. stupanj • II class	36 (25.7)	140 (100)			
III. N stupanj • III N class	44 (31.4)	140 (100)			
III. M stupanj • III M class	50 (32.9)	152 (100)			
IV. stupanj • IV class	40 (27.4)	146 (100)			
V. stupanj • V class	46 (31.5)	146 (100)			

*Omjer vjerojatnosti, **granice pouzdanosti, ***Hi-kvadrat test • *Odds Ratio, **Confidence Interval, ***Chi-square test

ne bolesti, vitamina C, konzumacije sportskih napitaka/mlijeka/jogurta i voća, pijenja kiselih napitaka prije spavanja, plivanja i rada u prostoriji bogatoj kloridima, stupnju obrazovanja i socijalno-ekonomskom statusu (tablica 2. i 3.). Povezanost između DE-a i mogućih rizičnih čimbenika raščlanjena je multiplom regresijskom analizom. Varijable koje su se unosile u model (prvi potez) bile su sljedeće: spol, želučani poremećaji, povraćanje, konzumacija voćnih sokova, gaziranih pića i octa te navika zadržavanja pića u ustima prije gutanja. Konačni model (regresijska metoda) uključivala je samo jednu od četiriju varijabli – povraćanje (p=0,031), konzumaciju voćnih sokova (p=,021), pijenje gaziranih pića (p=0,040) i naviku zadržavanja pića u ustima prije gutanja (p=0,001))(tablica 4.).

lation was recorded between DE and diabetes mellitus, asthma, use of chronic medication and vitamin C, sport drinks/milk/yoghurt and fruit consumption, the habit of consuming acidic drinks at bedtime, swimming and working in chlorinated environment, educational level and socio-economic status (Tables 2, 3). The association between DE and the possible risk factors was analyzed by the multiple logistic regression analysis model. The variables that entered the model (step one) were the following: gender, presence of gastric disorders, vomit, consumption of fruit juice, carbonated drinks, vinegar and the habit of holding drinks in the mouth. The final model (backward method) included only four variables: vomit (P=0.031), fruit juice consumption (P=0.021), consumption of carbonated drinks (P=0.040) and the habit of holding drinks in the mouth (P=0.001) (Table 4).

Tablica 4. Konačna povezanost DE-a i pojedinih čimbenika (backward-metoda)
Table 4 Final association between DE and several aspects (backward method)

Variables	B	Standard Error	P	Exp (B)	95% CI for EXP(B)
povraćanje • Vomiting	1.185	0.465	0.031	3.124	1.832-10.241
konzumacija voćnih sokova • Fruit juice consumption	0.825	0.367	0.021	2.652	0.912-4.886
konzumacija gaziranih pića • Carbonated drinks consumption	0.884	0.414	0.040	2.166	1.334-5.618
zadržavanje pića u ustima • Holding drinks in the mouth	1.387	0.442	0.001	0.422	0.132-0.437
Konstanta • Constant	0.424	0.344	0.543	0.655	

Rasprava

Prevalencija DE-a u ovom istraživanju nije u skladu s rezultatima ostalih studija kod kojih je iznosila od 5 do 97 posto (15 – 20). Ta se razlika može objasniti s nekoliko čimbenika, poput korištenih kriterija i indeksa za mjerenje DE-a koji mogu dovesti do prenaglašene prevalencije tih stanja, a i činjenice da je ponekad teško razlikovati i odvojiti eroziju od atricije i abrazije (21). Zato je moguće da su ti procesi uključeni i u neke slučajeve u ovom istraživanju. Osim toga teško je uspoređivati rezultate ranijih istraživanja jer su u mjerenja bili uključeni različiti zubi (22). Rezultati analize logističke regresije nisu pokazali razliku u prevalenciji DE-a između spolova, što se slaže s nalazima iz ranijih istraživanja (9) te se može objasniti sličnim načinima izlaganja rizičnim čimbenicima u ispitivanim uzorcima. U drugim istraživanjima ustanovljena je viša prevalencija kod muškaraca negoli kod žena (18, 19). Nije pronađena povezanost između dijabetesa melitusa i DE-a, iako su suha usta uobičajeni simptom te bolesti, pa zato postoji i opasnost od erozije zuba (4). Raniji izvještaji ne potvrđuju povezanost između astme i DE-a (22, 23), što je potvrđeno i u ovom istraživanju. Jane i suradnici (24) istaknuli su znatno više razine DE-a među astmatičnim pojedincima zbog kiselosti njihovih lijekova. Prema dosadašnjim istraživanjima, osim problema sa želucem (poput anoreksije nervoze i bulimije kod kojih je povraćanje glavni simptom) i gastroezofagealni refluks uzročnik je DE-a (16, 20, 21, 25-27). To je potvrđeno i u ovom istraživanju. Prema podacima iz literature, uporaba lijekova kiselog sasta-

Discussion

The prevalence of DE in the current study was not similar to the results of other studies in which it ranged from 5 % to 97 % (15-20). This variation may be explained by several factors, such as the different criteria and indices used in order to measure DE which could lead to overestimate the prevalence of this condition, the fact that it is often difficult to distinguish between the three main forms of tooth wear, i.e erosion, attrition and abrasion (21) and it is likely that these processes may have been included in some of the cases examined in the current study and the fact that it is difficult to compare the results of previous studies when different teeth are included in the measurement method (22). The results of logistic regression analysis showed no difference in the prevalence of DE between the genders, finding that was in agreement with the finding of a previous study (9) and may be explained by similar patterns of exposure to risk factors in the examined samples. Nevertheless, other studies have found a higher prevalence of DE in males compared to females (18,19). No association was observed between diabetes mellitus and occurrence of DE despite the fact that dry mouth is a common symptom of this disease and a risk factor of DE (4). Previous reports have demonstrated no association between asthma and DE (22, 23), findings that were in accordance with the present study. However, Jane et al. (24) recorded a significantly higher level of DE among asthmatic individuals because of the acidity of asthma medication. Gastric diseases such as anorexia nervosa and bulimia, are causative factors of DE according to previous reports (16,20,21,25-

va, poput aspirina, vitamina C, lijekova protiv astme ili onih koji smanjuju protok sline, može povećati rizik od nastanka DE-a (8, 9, 20, 28, 29). U ovom i u prijašnjim istraživanjima često korištenje lijekova, uključujući i vitamin C, nije povezano s erozijom zuba (18, 21, 30, 31). Učestalo konzumiranje gaziranih pića i voćnih sokova povezano je s DE-om, što se slaže s rezultatima većine dosadašnjih istraživanja (6, 17, 18, 23, 32-37) premda neki autori (9, 19, 23) nisu našli takvu poveznicu. U ranijim studijama istaknuto je da konzumacija sportskih napitaka snažno erozivno djeluje na zube (24, 33, 35 – 37), vjerojatno zbog njihova kelacijskog učinka na caklinski kalcij i povećanja pH (10). Rezultati ovog i nekih drugih istraživanja nisu to potvrdili (10, 38 – 40). Lussi i Jaeggi (6) smatraju da mlijeko štiti zube od erozije, što se ne slaže s rezultatima ovog i još nekih istraživanja (10, 20) kad je riječ o učinku mlijeka i mliječnih proizvoda poput jogurta. Ocat ima nizak pH i veliku mogućnost da prouzroči DE (6, 10). U ovom istraživanju nije pronađena povezanost između uporabe octa i pojave erozije zuba, premda se to ističe u nekim istraživanjima (1, 16). Konzumacija voća u ovom istraživanju nije bila povezana s DE-om, a to se slaže s dosadašnjim studijama (9, 10, 19, 23), iako mnogi istraživači smatraju da agrumi snažno djeluju na pojavu erozivnih lezija (20, 27, 30, 34 – 37). U nekoliko istraživanja ističe se da pojedinci koji imaju naviku zadržavati piće u ustima prije nego što ga progutaju, osobito gazirana pića, mogu imati veću sklonost prema DE-u (1, 30, 41). Ova opažanja u skladu su s rezultatima ovog istraživanja. Zadržavanje pića u ustima prije nego što se proguta utječe na pad pH na površini zuba i povećava opasnost od erozije. Slično je također ako se prije spavanja piju kiseli napici – i tada može nastati DE jer se u snu smanjuje protok sline. U ovom, kao ni u dosadašnjim istraživanjima (10) povezanost nije pronađena. Nekoliko pojedinaca u ovom je istraživanju izjavilo da često plivaju ili rade u prostoriji punoj klorida, no kod njih nije pronađena povezanost s razvojem erozivnih lezija. Ova opažanja ne slažu se s ranijim istraživanjima (11, 30, 42 – 44) možda zato što je samo nekoliko pojedinaca bilo izloženo takvim uvjetima. U literaturi se utjecaj stupnja obrazovanja i socijalno-ekonomskog statusa na DE istraživao uglavnom na uzorcima djece i adolescenata. Rezultati su kontradiktorni. Jedna od hipoteza koja bi mogla objasniti navedena opažanja jest u vezi s prehrambenim navikama, posebice s konzumacijom kiselih komponenti, poput gaziranih pića. Ti rizični čimbenici češći su u socijalnim skupinama s višim primanjima, ali raspodjela ne mora biti ista u svim zemljama. Dodatno, utjecaji socijalno-ekonomskog i ekonomskog statusa proturječni su te se u nekim istraživanjima ističe kako ne postoji veza između DE-a i socijalnog statusa kod djece i adolescenata. S druge strane, stupanj obrazovanja može utjecati na običaje u obitelji. To znači da pojedinci s višim stupnjem obrazovanja mogu više znati o oralnoj higijeni i steći bolje oralno-higijenske navike. Jasno je da je to pitanje potrebno još detaljnije istražiti. U ovoj studiji nije pronađena povezanost između socijalno-ekonomskog/obrazovnog statusa i DE-a. Erozija zuba je mnogostruka i mnogi čimbenici nisu bili predmet analize u ovom istraživanju, a mogu biti povezani s DE-om, poput zaštitnog učinka sline i povezanosti DE-a s abrazijom/

27), findings that were in agreement with the results of the current study. According to the literature, the use of chronic medication with an acidic composition such as aspirin, vitamin C, drugs prescribed for asthma treatment or medication that causes reduction in salivary flow rate could increase the risk of DE (8,9,20,28,29). The use of chronic medication, vitamin C included was not associated with the occurrence of DE in the present and previous investigations(18,21,30,31). The frequent consumption of carbonated drinks and fruit juices was shown to be associated with DE, finding that was in agreement with those observed in previous studies (6,17,18,23,32-37). However, other authors (9,19,23) did not report such an association. The previous reports have shown that the consumption of sport drinks has a strong erosive potential on teeth (24,33,35-37), possibly because their chelating action on calcium enamel continues with the pH increases (10). The findings of the present and other studies did not confirm the mentioned potential (10,38-40). Lussi and Jaeggi (6) suggested that milk has a protective effect against DE, finding which was not in agreement with those observed in the current and previous reports (10, 20) with respect to the mentioned effect of milk or milk-products, such as yoghurt. Vinegar has a low pH and a high potential to cause DE (6,10). The present study recorded no association between vinegar consumption and occurrence of DE, whereas previous studies confirmed such an association (1,16). The consumption of fruits was not related to DE in the present study, finding which was in agreement with those of previous studies (9,10,19,23), whereas many researchers found that citric fruits are dietary components of high impact on the occurrence of erosive lesions (20, 27, 30, 34-37). Several studies have demonstrated that individuals with the habit of holding drinks in the mouth, especially carbonated beverages, before swallowing, could have a greater susceptibility to DE (1,30,41). These observations are in accordance with the results of the present study. Holding drinks in the mouth before swallowing causes a marked pH drop at the tooth surface and increases the risk of erosion. Similarly, the consumption of acidic drinks at bedtime is another factor that could predispose to DE because the salivary flow is diminished during this period. However, no association was found in the present and a previous study (10). Few individuals reported the habit of frequent swimming or occupation in chlorinated environment in the present study and no associations were recorded between these variables and the development of erosive lesions. These observations were not in agreement with those observed in previous reports (11, 30, 42-44). This discrepancy could be attributed to the fact that few individuals reported the exposure in the mentioned environments. The influence of educational level and socio-economic status on the prevalence of DE has been investigated in samples consisting of children and adolescents mainly and have shown contradictory results. One hypothesis that could explain the mentioned finding is related to dietary habits, especially the consumption of acidic components, such as carbonated beverages. These risk factors are more prevalent among higher income social groups but this pattern may not be valid in all countries. The influence of socio-economic status and educational level are somewhat conflicting since some studies reported no relationship between DE and social class in chil-

atricijom. I drugi čimbenici, poput kulturnih, socijalnih i zanimanja te unutarnji i vanjski čimbenici domaćina mogu biti relevantni za pojavu DE-a. Identifikacija etioloških čimbenika povezanih s DE-om vrlo je važna za preventivne mjere. Posljednjih su se godina objavljivale epidemiološke studije i one s opisima slučajeva kako bi se pronašli mogući uzročnici DE-a. Ta istraživanja mogla bi otkriti poveznice i indikativne rizične čimbenike, ali ne i one etiološke jer bi za to trebalo provesti prospektivnu studiju. Zbog odgovarajućih preventivnih mjera potrebna su dodatna istraživanja kako bi se objasnila etiologija DE-a, s naglaskom na biološke, kemijske i ostale čimbenike ponašanja.

Zaključak

Ovo istraživanje pokazalo je da je DE velik problem u pregledanoj odrasloj grčkoj populaciji jer su kod 28,6 posto sudionika pronađene erozivne lezije. Navika zadržavanja pića u ustima prije nego što se proguta [OR=0,42, 95% CI=0,13 – 0,44] (P=0,001), pijenje gaziranih pića [OR=2,17, 95% CI=1,33 – 5,62] (P= 0,04) i voćnih sokova [OR=2,65, 95% CI=0,91 – 4,89] (P= 0,021) te povraćanje [OR=3,12, 95% CI=1,83–10,24] (P=0,031) čimbenici su najuže povezani sa zubnom erozijom.

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Izjava o sukobu interesa

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dren and adolescents. The level of education may influence the lifestyle of the family. That means that individuals with higher levels of education may have more knowledge of oral hygiene and better oral health habits. There is a need for more definitive research of those issues. However, in the current study, no association was recorded between socio-economic status/educational level and DE. DE is a multi-factorial condition and there are many factors that were not investigated in the current study and could be associated with DE, such as the protective effect of saliva and the association between DE and abrasion/attrition. In addition, other factors such as cultural, social, occupational and inter- and intra-individual host factors might be relevant to the occurrence of DE. The identification of etiological factors associated with DE is very important for the implementation of preventive measures. Epidemiological and case-control studies could show associations and indicative risk factors but they could not identify the etiological factors, because a prospective study is necessary for this purpose. Other studies are still necessary to explain the etiology of DE, focusing on the biological, chemical and behavioral factors involved in order to implement adequate preventive measures.

Conclusion

The current investigation showed that DE is an important problem in the population of Greek adults examined in the current study since it was estimated that 28.6% of the participants showed erosive lesions. The habit of holding drinks in the mouth before swallowing [OR=0.42, 95% CI=0.13-0.44] (P=0.001), carbonated drinks [OR=2.17, 95% CI=1.33-5.62] (P= 0.04) and fruit juices consumption [OR=2.65, 95% CI=0.91-4.89] (P= 0.021) and vomiting [OR=3.12, 95% CI=1.83-10.24] (P=0.031) were the most important associated factors of dental erosion.

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Conflict of interest

The author declares that he has no conflict of interests.

Abstract

Aim: The aim of the current research was to assess the prevalence of dental erosion and to investigate possible associations among dental erosion and epidemiological aspects, such as individuals' medical condition, dietary and lifestyle habits in a general dental practice. **Materials and Methods.** The sample consisted of 840 individuals, 396 males and 444 females aged 18 to 30 years. All participants were clinically examined and they answered questions regarding their medical condition, rate and frequency of drinks and food consumption, lifestyle habits, educational level, socio-economic and occupational status. Odds ratios with 95% confidence intervals (CI) were used to assess the univariate relationships among the examined variables. Statistical analysis of the questionnaire items was performed using the multiple logistic regression analysis model. **Results.** Two hundred and forty individuals were diagnosed as having dental erosion. The prevalence rate was 28.6%. The prevalence rate for dental erosion in males (34.3%) was significantly higher than in females (23.4%) (P= 0.013). The performance of regression analysis indicated that the habit of holding drinks in mouth before swallowing [OR= 0.42, 95% CI= 0.13-0.44], vomiting [OR= 3.12, 95% CI=1.83-10.24] and consumption of fruit juices [OR= 2.65, 95% CI= 0.91-4.89] and carbonated drinks [OR=2.17, 95% CI= 1.33-5.62] were the most important associated factors of dental erosion. **Conclusion.** The results of the study showed the correlation between dental erosion and some of the factors analyzed among the Greek adults while the prevalence of dental erosion was 28.6%.

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Address for correspondence
Dr. Nikolaos Andreas Chrysanthakopoulos
35, Zaimi Street, PC 26 223, Patra, GREECE
Tel./Fax: 0030-2610-225288
nikolaos_c@hotmail.com

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Dental Erosion; Vomiting; Carbonated Beverages; Greece

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