

Prevalence of dental erosion and association between socioeconomic factors in Turkish schoolchildren

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Background: This study's purpose was to assess the prevalence of dental erosion in adolescents and to evaluate the association between erosion and socioeconomic factors.

Methods: This study was carried out on 188 adolescents (14-16 years old) of both gender who attending Dentistry Faculty of Konya, Turkey. A calibrated examiner used the O'Brien index for assessment of dental erosion on the buccal and palatal surfaces of the permanent maxillary incisors and on the occlusal surfaces of the permanent first molars. Data on age, gender, mean family income and parental educational status were collected by a questionnaire completed by the subjects. Descriptive statistics were applied to the data, and the associations between erosion and socioeconomic variables were investigated by chi-square test ($P < 0.05$).

Results: 17.5% ($n=33$) of the subjects exhibited dental erosion, with only enamel being involved. Occlusal surface of the lower first molar was the most commonly affected teeth (7.57%); followed by palatal surface (2.59%) and buccal surface (1.46%) of maxillary incisors, respectively. There was no correlation between dental erosion and age, gender, socioeconomic factors.

Conclusion: No statistically significant association was observed between erosion, age, gender and socioeconomic factors. In Turkey, dental erosion seems to be a significant, but not serious problem for dental health in adolescents.

KEY WORDS

Adolescents, socioeconomic factors, tooth erosion.

Studies have shown a growing trend toward increasing prevalence of dental erosion, associated with the declining prevalence of caries disease in industrialized countries (Wang and Lussi 2010). Dental erosion is the result of a pathologic, chronic, localized loss of dental hard tissue that is chemically etched away from the tooth surface by acid and/or chelation without bacterial involvement (Imfeld 1996). The etiology of tooth erosion is multifactorial and it may be caused by intrinsic, extrinsic, or idiopathic factors (Wiegand et al 2006). Studies have reported the etiology of erosion and its association with clinical conditions (dental enamel hypoplasia and caries), behavioral (dietary habits and oral hygiene), gastroesophageal reflux disease (GERD), demographic, and socioeconomic factors (age, gender, social class, educational level and household income) (Vargas-Ferreira et al 2011).

Studies about prevalence, etiology and pathogenesis of dental erosion have been carried out throughout the world. Data on the prevalence of erosive lesions of the permanent dentition in adolescent have been published in recent years, with results ranging from 13 up to 95% in enamel and from 0 up to 26% in dentine (Al-Majed et al 2002, Çağlar et al 2005, Gurgel et al 2011). Nevertheless it is difficult to compare the results of epidemiological studies because of

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different examination standards used (calibration of examiner(s), scoring system, number and site of teeth) and different nonhomogeneous groups examined (age, gender, number of examined individuals, geographical location) (Wang and Lussi 2010).

There is a lack of information about the influence of socioeconomic variables on tooth erosion. Previous studies have shown contradictory results. Some studies indicate that dental erosion is more prevalent in subjects having a higher socioeconomic status (Bardsley et al 2004, Peres et al 2005), while others show more erosion in lower socioeconomic groups (Kazoullis et al 2007, Milosevic et al 1994). Overall, in previous studies, authors did not find any differences between socioeconomic groups and dental erosion (Auad et al 2007, Dugmore and Rock 2004).

Studies about possible prediction for tooth erosion are important and this might lead to the diagnosis of lesions in an early stage and to the identification of their possible causes, aiming to maintain the oral health of adolescents (Bardsley et al 2004). More epidemiological studies are still necessary to evaluate the prevalence of dental erosion and to establish preventive and treatment measures in adolescent (Gurgel et al 2011). Thus, this study's objectives were to (a) assess the prevalence and severity of dental erosion in 14-16-year-old schoolchildren from Konya, Turkey, (b) compare the prevalence of dental erosion in genders and socioeconomic condition.

SUBJECTS AND METHODS

A study was performed on Selcuk University Dentistry Faculty, Konya, Turkey. A sample of 188 adolescents (14-16-year old schoolchildren) of both genders participated in this study. Subjects were included in the study only if they presented the written positive consent from their parents to participate in this study.

All subjects were clinically examined by the same observer (S.K.), (who had previously undergone extensive training and calibration exercises in the use of the index) under standard illumination from mouth mirrors. Calibration exercises were carried out before starting the study to ensure that the examiner was reliable and reproducible using the index.

The distribution and severity of dental erosion were graded using the O'Brien Index (1994). The clinical examination included the evaluation of the buccal and palatal surface of the permanent maxillary incisors and the occlusal surface of the permanent first molars. The congenitally missing or extracted

teeth and teeth with full crown coverage or large restoration were excluded from data collection (code: 9). Therefore, a maximum of 12 surfaces of 8 teeth (four permanent first molars and four maxillary incisors) were examined per subject for erosion. Each available tooth surface was graded with a score ranging from 0 to 9, based on the O'Brien Index (Table 1).

Table 1.

O'Brien Index

Code 0	No Erosion
Code 1	Enamel only, loss of surface characterization
Code 2	Enamel and dentine, loss of enamel exposing dentine
Code 3	Enamel into pulp, loss of enamel and dentine resulting in pulp exposure
Code 9	Assessment cannot be made

The socioeconomic data were collected by means of a questionnaire completed by the subjects, which included questions about age, gender, parental educational status and family income. For the purpose of this study, parental educational status was classified into "no education" (no school attendance at all), "low education" (primary school), "medium education" (high school) or "high education" (college). Family income was classified as "low", "medium", "high".

To assess the reproducibility of the diagnostic criteria application, the intra-examiner calibration was performed. An intra-examiner test was conducted by re-examining 20 randomly selected subjects 7 days after the first examination. The level of intra-examiner agreement was measured using Cohen's kappa statistics. Differences in the prevalence of dental erosion, according to gender, mean family income and parental educational status, were tested in terms of frequencies using the nonparametric chi-square tests in SPSS13.0 (SPSS Inc, Chicago, IL, USA) software system. Significance was accepted at the $p < 0.05$ level.

RESULTS

1504 teeth at 188 subjects (106 females and 82 males) were examined in this study. Of these 1504 teeth 9 incisors and 17 molars could not be examined because of the extensive caries, large restoration and were not included in the analysis (code-9). Of the 188 subjects examined, 155 (82.5%) did not exhibit any clinical signs of dental erosion and 33 (17.5%) showed erosion at least 1 dental surface. In all the examined eroded surfaces, only enamel was affected. There was no evidence of

erosion in dentine (code: 2) and exposing pulp (code: 3). Intra-examiner agreement for scoring erosion was good with a Kappa value of 83%.

Only a small difference in prevalence of erosion between females (18 of 106; 16.9%) and males (15 of 82; 18.2%) existed (Table 2). It is obvious that prevalence of dental erosion in permanent dentition increases with increase subject's age. The number and percentage of subjects exhibiting erosive lesions according to the age groups is seen in Table 3.

Table 2.

Number and percentage of subjects with dental erosion by gender

Gender	Erosion absent	Erosion present	Total	P-value
Male	67 (%81)	15 (%19)	82	0,481
Female	88 (%83)	18 (%17)	106	
Total	155 (%82.5)	33 (%17.5)	188	

Table 3.

Number and percentage of subjects with dental erosion by age group

Age	Erosion absent	Erosion present	Total	P-value
14	50 (%84.8)	9 (%15.2)	59	0,4
15	52 (%83.9)	10 (%16.1)	62	
16	53 (%78.8)	14 (%20,8)	67	

A total of 87 teeth surface were affected by dental erosion. Analysis according to the affected surface is given in Table 4. Dental erosion was more frequent in the occlusal surface of permanent first molars (7.57%), followed by the palatal surface of maxillary incisors (2.59%) and by the surface of buccal surface of maxillary incisors (1.46%). The prevalence of dental erosion in relation to socioeconomic status is listed in Table 5. There was no correlation between the presence of erosion and socioeconomic factors.

Table 4.

Number and percentages of surfaces involved in dental erosion

O'Brien Index	Erosion absent (Code:0)	Erosion in enamel (Code:1)	Erosion in dentin (Code:2)	Erosion with exposing pulp (Code:3)	Cannot Assessment (Code:9)	Percentage
Occlusal	678	57	0	0	17	%7.57
Palatal	726	19	0	0	7	%2.59
Buccal	739	11	0	0	2	%1.46

Table 5.

Association between socioeconomic factors and dental erosion

Erosion variable	Erosion absent	Erosion present	Total	Percentage	P-value
Mean family income					
Low	6	1	7	%14.2	0,379
Medium	126	25	151	%16.5	
High	23	7	30	%23.3	
Educational status (Father)					
No	1	0	1	-	0,114
Low	45	6	51	%11.7	
Medium	41	8	49	%16.3	
High	68	19	87	%21.8	
Educational status (Mother)					
No	13	1	14	%7.1	0,343
Low	68	15	83	%18.1	
Medium	39	7	46	%15.2	
High	35	10	45	%22.2	

DISCUSSION

There is evidence that the prevalence of dental erosion is gradually increasing (Auad et al 2007). Turkey has a young population of 20 million children aged 0 to 16 years old. Sales management techniques and advertisements, therefore, are mostly established regarding the dietary habits of children (Bardsley 2008). However, because of a difficult diagnosis, epidemiologic studies of dental erosion have shown a great diversity of methodological procedures, resulting in variations

in the scoring systems that need to be considered when comparing with the previous studies (Wang and Lussi 2010). A modified version of the O'Brien (1994) index was chosen for this study because it is the most commonly used index in the permanent dentition and it possesses most of the ideal characteristics of an index, as listed by Bardsley (2008).

The use of permanent upper incisors and molars when investigating dental erosion in 14-16 year-old children is appropriate since, at this age, these teeth have been exposed in the mouth for a considerable length of time (at least 8 years) when compared to other teeth. Thus, incisors and molars are more exposed to possible intrinsic and extrinsic etiological factors which may cause dental erosion. However, confining examination to incisors and molars was thought to make the index easier to use in large studies (Peres et al 2005).

A 17.5 percent prevalence of tooth erosion was found among 14 to 16-year-old schoolchildren. The prevalence found in this study was lower than the findings reported by other author in Turkey (Çağlar et al 2005). For instance, Çağlar et al (2005) analyzed 153 children aged 11 year-old and found that 28% of them had erosion. The prevalence found in this study was lower than the majority of findings reported by several other authors in different countries (Gurgel et al 2011, Al-Majed et al 2002, Bardsley et al 2004, Milosevic et al 1994). Dental erosion has been reported at an incidence of 20% in a total of 484 Brazilian schoolchildren (Gurgel et al 2011). In Saudi Arabia, 26% of 12- to 14-year-old boys showed signs of dental erosion (Al-Majed et al 2002). Another study (Vargas-Ferreira et al 2011) examined the permanent dentition of Brazilian 11-14 year old and found lower prevalence values with 7.2%. On the other hand, Peres et al (2005) analyzed 499 children aged 12 year-old and found that 13% of them had erosion. Our result is slightly higher than the results of a study conducted by Ganss et al (2001), who found that 11.6% of children with permanent teeth had at least one tooth with some level of erosion. The above authors had used pre-orthodontic study models from 1000 individuals between 1977 and 1999 in Germany. The reasons for these different results may be explained by the absence of a standardized index, type of teeth examined, sample size, age, and socioeconomic and geographical factors that could influence the outcome (Vargas-Ferreira et al 2011).

The prevalence of dental erosion was numerically higher among 16-year-olds (20.8%) than 15 year-olds (16.1%) and 14 year-olds (15.2%), respectively. A similar trend was observed in longitudinal surveys

in adolescents (Gurgel et al 2011, Ganss et al 2001) in which the progression and severity of dental erosion increased in the subject with time. On the other hand, all erosion lesion found in our study were confined to enamel. This fact can be attributed to the low intensity of the risk factors and to the relatively low contact time with the etiologic factors (Çağlar et al 2005, Peres et al 2005, Auad et al 2007, Deery et al 2000).

There is scarce information about the impact of demographic and socioeconomic factors on the prevalence of tooth erosion. Generally, the results are contradictory. In this study, there was no difference in the prevalence of dental erosion between males (19%) and females (17%), which is in agreement with a study carried out by Deery et al (2000) in the UK and the USA. Contrasting results have also been reported in the literature: authors (Milosevic et al 1994, Dugmore and Rock 2004) found statistically significant more erosive lesions in males than females. Milosevic et al (1994) found a significantly higher prevalence of exposed dental erosion in males than in females, mainly affecting the incisal edge. It has been suggested that a higher rate of tooth erosion could be attributed to differences in the strength of musculature and biting forces, and also to a higher consumption of acidic drinks among males (Bardsley et al 2004).

In the present study, socioeconomic factors were not associated with the prevalence of tooth erosion, a result that is in accordance with previous findings (Al-Majed et al 2002, Dugmore and Rock 2004, Auad et al 2007). Other studies, however, have shown a correlation between socioeconomic status and tooth erosion (Bardsley et al 2004, Peres et al 2005). In general, children from high socioeconomic backgrounds showed a higher prevalence of tooth erosion. In a Brazilian study, tooth erosion was significantly more prevalent among 12-year-old children at private schools when compared with those registered at public schools (Peres et al 2005). Some studies reported relationship between erosion and social class based on the education of the father and mother (Al-Malik et al 2001). Our results showed that children whose fathers and mothers had higher levels of education exhibited more lesions, which is in contrast with the study by Wang et al (2010). Their study suggested the relationship between the level of education of the mother and the presence of erosion in the children may be due to the influence of the level of education on the lifestyle of the family. They suggested that mothers who had higher levels of education may have more knowledge of oral hygiene and better oral health habits (Wang et al 2010). These differences maybe explained a higher parental education and parents

spending more time away from home might be influencing the increased amount and frequency of fast food and carbonated drink consumption of children in the last years. Further research is required to monitor prevalence and establish clearer associations between erosion and socioeconomic status.

The most frequently affected surface was the occlusal in molar teeth only (7.57%) for all study teeth, followed by the palatal (2.59%) and (1.46%) buccal surfaces of maxillary incisors. Al-Majed et al (2002) also determined that 91% of dental erosion occurred on the occlusal surfaces of 12-14-year-old Saudi boys. The results of other surveys varied. For example, Auad et al (2007) and Manguera et al (2009) reported that the palatal surfaces were the most affected. The consumption of erosive drinks and food was also shown to be strongly associated with erosion on the facial and occlusal surfaces, while severe palatal erosion occurred infrequently and were highly associated with chronic vomiting (Lussi et al 1991). The predominant affected surfaces of erosion on the occlusal might result from these tooth surfaces being predisposed to physical impacts from mastication, which promotes the effect of erosion. Although distinguishing erosion from abrasion/attrition in the occlusal surfaces at the late stages of permanent dentition is difficult, the dentition of 14-16-year-old schoolchildren is during the early stages and the appearance of the occlusal surfaces as cupping is mainly due to erosion.

CONCLUSIONS

In conclusion, a low prevalence of dental erosion was observed in this group of Turkish schoolchildren. Dental erosion seems to occur most often in occlusal surface of molar teeth of schoolchildren whose fathers or mothers had a high educational status.

Okul çağındaki Türk çocuklarında diş erozyonu görülme sıklığı ve sosyoekonomik faktörlerle ilişkisi

Amaç: Bu çalışmanın amacı ergenlerde diş erozyonu görülme sıklığını incelemek ve sosyoekonomik faktörler ile ilişkisini değerlendirmektir.

Gereç ve Yöntemler: Bu çalışma Selçuk Üniversitesi Diş Hekimliği Fakültesine başvuran 188 (14-16 yaş arasındaki) ergen üzerinde gerçekleştirildi. Bireylerin üst kesici dişlerinin bukkal ve palatinal yüzeyleri, daimi birinci büyük azı dişlerinin okluzal yüzeyleri deneyimli bir araştırmacı tarafından O' Brien indeksine göre değerlendirildi. Bireylerden yaş, cinsiyet, ortalama gelir düzeyi anne-baba eğitim düzeyi konularında sorular içeren anket formunu doldurmaları istendi. İstatistik analiz için Chi-square testi kullanıldı.

Bulgular: Bireylerde erozyon görülme sıklığı %17.5 (n=33) olarak bulundu. Eroziv alanların sadece mine seviyesinde olduğu tespit edildi. Daimi birinci büyük azı dişlerin okluzal yüzeyi en çok etkilenen yüzey (%7.57) olarak bulunurken, bunu üst kesici dişlerin palatal (%2.59) ve bukkal yüzeylerinin (%1.46) takip ettiği görüldü. Diş erozyonu ve yaş, cinsiyet, sosyoekonomik faktörler arasında anlamlı bir ilişki bulunmadı ($P>0,05$).

Sonuç: Diş erozyonu ve yaş, cinsiyet, sosyoekonomik faktörler arasında ilişki tespit edilmedi. Türkiyede ergenler arasında diş erozyonunun henüz ciddi seviyede olmayan bir problem olduğu söylenebilir.

ANAHTAR KELİMELE

Diş erozyonu, ergen, sosyoekonomik faktörler

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