

Original Article

Dental erosion among 12-15-year-old school boys in southern Saudi Arabia

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Abstract The aim of this study was to determine the prevalence and severity of dental erosion in 12-15-year-old schoolchildren and to compare prevalence between public and private school boys. This cross-sectional study was carried out on 1000, 12-15-year-old school boys in Abha, Saudi Arabia. Dental erosion index proposed by O'Sullivan was used for the four maxillary incisors. Data analysis included descriptive statistics, location, distribution, and extension of affected area and severity of dental erosion. The prevalence of dental erosion was 25.60% with no significant difference between private and public school students. Matt appearance of the enamel was the most prevalent type of dental erosion (63.63%). In most of the involved cases, more than half of their surfaces were diagnosed as affected by erosion (78.49%). Labial surfaces were the most affected (80.90%), while incisal surfaces were least affected (0.22%). Thus it can be concluded that dental erosion among Saudi school boys is becoming a significant problem, hence it is essential to provide adequate preventive care, and healthier dietary habits campaign for Saudi children.

Keywords: Dental erosion, school boys, Saudi Arabia.

Introduction

Dental erosion is defined as the chemical dissolution of the dental tissues without bacterial involvement (Pindborg, 1970). The underlying etiology of erosion is believed to be a source of acidic action on a susceptible tooth. It may be caused by exposure of teeth to frequent consumption of acidic drinks or foods, environmental exposure to acids, or reflux of gastric acid into the mouth (Scheutzel, 1996; Zero, 1996). Symptoms of dental erosion range from sensitivity to severe pain associated with pulp exposure, altered occlusion and poor aesthetics (Luo *et al.*, 2005). Moreover, such tissue loss is insidious in nature and may not be apparent until the patient reports of sensitivity or the fracture of thinned incisal edges (Nunn, 1996).

Erosion is recognized as an important cause of loss of the tooth tissue for adults, children and adolescents (Millward *et al.*, 1994; Harding *et al.*, 2003).

To prevent further progression, it is important to detect this condition as early as possible (Lussi and Jaeggi, 2008). Life style and behavior differences must also be considered as having an important role in dental erosion.

Epidemiological surveys have investigated dental erosion in developed and developing countries. These results have shown that the prevalence of dental erosion varies considerably in different countries, geographical locations, and age groups (Wang *et al.*, 2010). The sample age group in studies of the prevalence of dental erosion was 3-50 years old (Amaechi and Higham, 2005). Most of the studies have focused on 12-year-old children because the permanent incisors and first molars of children at this age have been exposed to potential etiological factors in the mouth for a considerable duration compared to other teeth (Wang *et al.*, 2010).

A high prevalence of tooth wear among Saudi Arabian adults has been reported (Fareed *et al.*, 1990; Johansson *et al.*, 1991). However, there is no data on prevalence of dental erosion of the present study population from this region of Saudi Arabia. Hence, the present study was conducted to assess the prevalence and severity of dental erosion among 12-15-year-old school boys in Abha, Saudi Arabia and to compare prevalence between public and private school boys.

Materials and methods

Abha is the capital city of Asir province, which is located in Southern Saudi Arabia. The city is surrounded by a good number of villages, making it a suitable site to study the prevalence for dental erosion in children in Saudi Arabia. The system of schooling in the Kingdom of Saudi Arabia provides females with their own schools and entire female staff. During school hours males are not allowed to enter the female schools. Due to the school rules in Saudi Arabia, which separate genders in all levels of education, boys only were included in this school-based study.

A cross-sectional study was conducted in Abha by a stratified multistage cluster sampling. A pilot study involving 30 school boys was performed before the formal study. To derive the sample, intermediate schools in Abha were stratified by funding source (private or public) and by the area of the city. A list of all intermediate schools in the city was obtained from the Department of Education. A random sample was selected from public and private schools in each of four geographical areas of the city. A total of 1052 school boys in the age group of 12-15-year-old from both public and private schools were invited to participate in the study. These numbers were designed to ensure the sample represented all areas of the city and to allow an estimation of the effect of school type attended. Approval of the study was obtained from the concerned authorities including Health and Education Department. The study was approved by Research Ethics Committee of College of Dentistry, King Khalid University (Ref No 025/2011-12). An informed consent letter

regarding the aim and importance of the study was signed by the children and the parents/guardians before starting the survey, thus assuring the children participated in the study on their own accord. Fifty two boys were absent at all school visits of which twenty seven from private schools and twenty five from public schools, thus making the final study sample of 1000. The results therefore relate to 1000 school boys in the age group of 12-15 years old.

An experienced epidemiologist was responsible for training and calibrating three examiners. The diagnostic criteria of dental erosion were thoroughly discussed with examiners and were reviewed via photographic images during the calibration exercise. Reliability was assessed through the Kappa scores. Intra-examiner reliability during field work was checked with duplicate examinations of every tenth subject. The clinical examination was performed in the classroom under standard artificial illumination using plane mouth mirrors and sterilized gauze to remove gross debris. The four upper incisors were examined. Each examination lasted for 45 seconds on average. The dental erosion index proposed by O'Sullivan was adopted to record the distribution, severity and amount of affected teeth. Children with orthodontic appliances, hypoplasia, extensive restorations and fractured or missing teeth of incisors were excluded.

The socio-demographic data collected included the age and type of school. Type of school refers to the differentiation of students enrolled in public and private schools. Since public schools do not collect tuition fees, it was assumed, as in previous studies that children attending private schools would be of higher socioeconomic status than those enrolled in public schools (Al-Malik *et al.*, 2002).

O'Sullivan index for measurement of dental erosion:

- 1) Erosion site on each tooth:
 - a. Code A: Labial or buccal only
 - b. Code B: Lingual or palatal only
 - c. Code C: Occlusal or incisal only
 - d. Code D: Labial and incisal /occlusal
 - e. Code F: Multi surface

2) Grade of severity (worst score recorded for an individual tooth):

- a. Code 0: Normal enamel
- b. Code 1: Matt appearance of the enamel surface with no loss of contour
- c. Code 2: Loss of enamel only (loss of surface contour)
- d. Code 3: Loss of enamel with exposure of dentine (dentinoenamel junction visible)
- e. Code 4: Loss of enamel and dentine beyond dentinoenamel junction
- f. Code 5: Loss of enamel and dentine with exposure of the pulp
- g. Code 9: Unable to assess (e.g. tooth crowned or large restoration)

3) Surface area affected by erosion:

- a. Code (+): less than half of surface affected
- b. Code (-): more than half of surface affected

Results

Out of the 1,052 invited subjects, a total of 1,000 school boys aged between 12-15 years old were examined, thus the response rate was at 95%. The main reasons for non-response were absence on the day of examination and lack of parental consent. Out of the 1000 school boys examined, 500 were from private schools and the rest of them were from public schools. A total of 256 children were affected by erosion, accounting for the prevalence rate of 25.60% (Table 1). Table 1 also shows that there was no significant difference between school types, though private school children exhibited a slightly higher percentage of erosion.

Of the total surfaces affected (n=451), 80.90% and 7.98% were identified in labial and palatal surfaces respectively. However multisurface erosion was seen in 10.01% of the affected population, while the least affected was incisal surfaces accounting for 0.22%. However erosion involving both labial and incisal surface was 0.89% (Table 2). Concerning the severity of dental erosion (Table 3) among the study population, matt

appearance of the enamel was the most prevalent type of dental erosion (63.63%) followed by loss of enamel only (24.61%). Loss of enamel with exposure of dentin was 8.87% and pulpal exposure accounted for 2.89%. Regarding the area of the surface affected by dental erosion (Table 4), 78.49% of the affected surfaces exhibited less than half of the area affected while 21.51% exhibited more than half of the surface affected.

Table 1 Prevalence of dental erosion in 12-15-year-old school boys according to type of school in Abha, Saudi Arabia

| Type of school | Yes [n (%)] | No [n (%)] | Total [n] | Pearson Chi-Square Test, df=1 (p-value) |
|----------------|-------------------|-------------------|-------------|-----------------------------------------|
| Private | 134 (26.8) | 366 (73.2) | 500 | 0.7560 (0.3845)* |
| Public | 122 (24.4) | 378 (75.6) | 500 | |
| Total | 256 (25.6) | 744 (74.4) | 1000 | |

* Significant at the 0.05 level

Table 2 Number (%) of tooth surfaces affected by dental erosion in 12-15-year-old school boys, Abha, Saudi Arabia

| Affected surface | Number | % |
|------------------------------|------------|------------|
| Labial only (Code A) | 364 | 80.90 |
| Palatal only (Code B) | 36 | 7.98 |
| Incisal only (Code C) | 1 | 0.22 |
| Labial and incisal (Code D) | 4 | 0.89 |
| Palatal and incisal (Code E) | 0 | 0.00 |
| Multi-surface (Code F) | 46 | 10.01 |
| Total | 451 | 100 |

Table 3 Severity of dental erosion in 12-15-year-old school boys in Abha, Saudi Arabia

| Location | Number | % |
|----------------------------------------------------------------|------------|------------|
| Matt appearance of the enamel without loss of contour (Code 1) | 287 | 63.63 |
| Loss of enamel only (Code 2) | 111 | 24.61 |
| Loss of enamel with exposure of dentin (Code 3) | 40 | 8.87 |
| Pulpal exposure (Code 4) | 13 | 2.89 |
| Total | 451 | 100 |

Table 4 Area of the surface affected by dental erosion in 12-15-year-old school boys in Abha, Saudi Arabia

| Area affected | Number | % |
|-------------------------------------------------|------------|------------|
| Less than half of the surface affected (- code) | 354 | 78.49 |
| More than half of the surface affected (+ code) | 97 | 21.51 |
| Total | 451 | 100 |

Discussion

A wide range of prevalence of dental erosion has been reported in upper permanent incisors. This may be due to the relatively small number of subjects in the majority of studies and the use of different criteria for diagnosis (Linnett and Seow, 2001). The use of upper incisors when investigating dental erosion in 12-15-year-old children is appropriate since at this age, these teeth have been exposed in the mouth for a considerable length of time when compared to the other teeth. Other studies have included the molars since these teeth have also been shown to be susceptible to erosion. However, confining the examination of incisors in large societies had proved to be an easier task (Peres *et al.*, 2005).

It is difficult to distinguish the three main types of tooth wear i.e. erosion, attrition and abrasion, and it is likely that all three processes may have been included in some of the cases seen in this study. The use of a smaller number of index teeth may make it easier to achieve good validity. According to Steele and Walls (2000), it is difficult to train examiners to measure any one of these conditions to a high level of agreement, let alone all of them. Moreover, the full assessment of all of these conditions is very time consuming.

In this study the prevalence of dental erosion among 12-15-year-old schoolchildren was found to be 25.6%. This prevalence is similar to the results of a study conducted by Ganss *et al.* (2001). Milosevic *et al.* (1994) reported that 30% of 14-year-old children exhibited exposed dentin because of erosion in Liverpool, UK. Pronounced dental erosion was observed

in 26% of a sample of 12-14-year-old in Riyadh, Saudi Arabia (Al-Majed *et al.*, 2002). A very high prevalence of dental erosion was also observed in the USA among 11-13-year-old children (Deery *et al.*, 2000). Another study conducted in Birmingham, UK found 48% prevalence among 14-year-old schoolchildren (Al-Dlaigan *et al.*, 2001). A higher prevalence than this study was also reported for a random sample of 12-year-old schoolchildren living in Leicestershire and Rutland, UK where 56.3% of subjects had some level of dental erosion (Dugmore and Rock, 2003).

The differences observed between the results of this study and those of other investigations may be explained by several factors. First, the different criteria used in the various studies could be at least partly the reason for this discrepancy. The Tooth Wear Index (TWI) (Smith and Knight, 1984) is the most extensively adopted index to measure dental erosion and consequently measure different types of tooth wear. Secondly, it is difficult to compare the results of prevalence studies when different teeth are included in the measurement method. Standardization of the indices and the teeth examined would facilitate such comparisons. Finally, the permanent dentition analyzed in different studies shows erosion at ages ranging from 12 to 14 years old, which may also influence the results through differences in time of exposure to risk factors.

The predominance of erosion on the labial surface seen in this study is in agreement with previous data (Williams *et al.*, 1999; Al-Majed *et al.*, 2002). The results of other surveys varied, such as Auad *et al.* (2007) and Manguera *et al.* (2009) reported palatal surfaces were affected the most while Wang *et al.* (2010) reported incisal or occlusal surfaces were most affected.

The severity of erosive lesions in the present study demonstrated matted appearance of enamel without loss of contour occurred most frequently (63.63%) while only a small proportion of tooth surfaces were affected with dentine exposure (8.87%). Peres *et al.* (2005) also reported matted appearance of enamel

without loss of contour as the most prevalent type of dental erosion among Brazil schoolchildren. However, Al-Majed *et al.* (2002) reported 26% of pronounced dental erosion (erosion into dentin or pulp) among Saudi Arabian boys of 12-14 years of age.

In the present study, the type of school was regarded as a representation for social class, whereby those attending private schools being from higher socio economic status. In regard to the influence of socioeconomic status on the prevalence of dental erosion, previous studies have shown contradictory results. Millward *et al.* (1994) found a higher prevalence of erosion among children of higher socioeconomic status than those among underprivileged children in Birmingham, UK although the children included were of younger age than those in the current study. In contrast, Al-Dlaigan *et al.* (2001) reported a significantly higher prevalence of erosion in teenagers of the lowest socioeconomic group in Birmingham, UK and Milosevic *et al.* (1994) also found a slight positive association between tooth wear and the level of social deprivation in Liverpool, UK. However, in the present study there was no statistically significant difference in prevalence of erosion between private and public school boys.

Conclusion

Dental erosion was observed in 25.60% of 12-15-year-old boys in one or more permanent maxillary incisors. This evidence of dental erosion is becoming a significant problem in Saudi school children. Hence it is essential to provide adequate preventive care and healthier dietary habits campaign for Saudi children. The present study has limitations because of cross sectional study design and a small sample size of suburban residents. Therefore, the authors recommend further longitudinal epidemiological studies in Saudi Arabia to measure the incidence of dental erosion as well as to assess its risk factors and impact, if any on children's quality of life.

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