

Prevalence and risk indicators of erosion in 13-14-year-olds on the Isle of Man.

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Short title: Erosion in 13-14-year-olds on Isle of Man

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Abstract

Background/Aims: The aim was to determine the prevalence of erosion in 13-14 year-old children on the Isle of Man and to investigate the strength of association with dietary risk factors.

Methods: Exposed dentine was assessed on smooth surfaces of incisors/canines and occlusal surfaces of first molars. A questionnaire assessed consumption frequency of foodstuffs.

Results: Of 629 children examined, 124 (20%) had dentine exposed labially, palatally or occlusally. More males had dentine exposed on these surfaces (OR=1.7, 95% CI 1.2 to 2.6). Palatal dentine exposure was present in 3% of children, and occlusal dentine exposure in 18%. In bivariate analyses, drinking fizzy drinks more than once a day was associated with erosion (OR 1.6; 95% CI 1.1 to 2.3). Mean DMFT scores were not statistically different for children with smooth surface/occlusally exposed dentine (1.37) compared to those without (1.58). Multiple regression analysis showed age, gender and toothbrushing to be significant predictors of erosion.

Conclusion: This study has found a higher proportion of 13-14 year old children with exposed dentine in molars than previous studies. The results corroborate previous reports that males have more erosion than females.

Introduction

Several cross-sectional and a few longitudinal studies have described the intra-oral distribution, prevalence and severity of erosion in adolescents [Bartlett et al., 1998; Williams et al., 1999; Al-Dlaigan et al., 2001; Ganss et al., 2001; Dugmore CR and Rock WP, 2004a,b; Bardsley et al., 2004; Milosevic et al., 2004; Auad et al., 2007; El Aidi et al., 2008]. Although tooth wear and erosion are not synonymous, difficulty arises when attempting to distinguish acid eroded teeth from worn teeth as a result of attrition (direct contact tooth-to-tooth wear) and abrasion. This was highlighted in the last UK National Survey of Child Dental Health (2003) when the term tooth surface loss (TSL) replaced erosion, as used in the previous survey (1993), because TSL more accurately reflected the multifactorial aetiology of the condition [Chadwick et al, 2006]. The trend from the epidemiological studies points to increasing prevalence of erosion between different age cohorts [Nunn et al, 2003].

This study aimed to determine the prevalence and severity of erosion by assessment of smooth and occlusal surfaces in 13/14- year-old children on the Isle of Man (IoM). Furthermore, the association between erosive wear and age, gender, dietary variables and caries experience was evaluated.

Materials and Methods

This investigation was part of the European Longitudinal Study of Parents and Children (ELSPAC) health study, which was set up in 1987 and has monitored

the health of children from their birth. At the time of the assessments reported in this study (2006), the children were aged 13-14 years.

The study received ethical approval from the IoM Ethics Committee and was conducted with the full co-operation of the local Community Dental Service, Department of Public Health and Department of Education. Study information detailing the aim, procedures and expected use of the data was provided to parents and children. This information was sent to pupils' parents/guardians to obtain positive consent to participate in this study. All secondary school pupils in years 8 and 9 (aged 13-14 years) were invited to take part from 6 Isle of Man secondary schools on 5 sites. 1100 children were approached, the number of children who consented and were available during the week of the study was 629, and of these 530 were from the original ELSPAC cohort. As the analysis presented here does not use the historic ELSPAC data, all children examined were included in the sample.

Training and calibration exercises for all examiners took place over a three month period prior to the main survey and involved training on photographs, study models and finally 16 children on the Isle of Man. All examiners trained and calibrated together. Kappas for agreement were calculated on the children included in the calibration exercise.

The epidemiological survey was conducted over 5 days and assessed oral cleanliness, caries and erosive wear. Examinations were carried out in schoolrooms by one of four calibrated teams under standardised conditions with children lying in the supine position. Teeth were dried using cotton wool

rolls/sticks and examined with a disposable mouth mirror with illumination from a portable Daray light source. All cross-infection control measures and clinical equipment complied with the British Association for the Study of Community Dentistry (BASCD) guidelines for dental epidemiological studies of child dental health in the U.K. [Pitts et al., 1997].

An assessment of caries was made following diagnostic criteria from BASCD guidelines [Pitts et al., 1997], which records caries experience at the dentinal level. Erosive wear was measured using a modified partial recording index [Bardsley et al., 2004], in which the labial, incisal, palatal/lingual surfaces of the 12 anterior teeth and the occlusal surface of the first molars are assessed. The rationale for the choice of index teeth was based on the study by Steele and Walls [2000], who reported that the inclusion of all 12 anterior teeth resulted in greatest sensitivity. Surfaces were scored dichotomously as 0 (absence of exposed dentine) or 1 (exposed dentine visible) and thus did not discriminate with respect to wear within enamel. If examiners were unsure, they were instructed to score low and underestimate. A questionnaire measured reported tooth brushing habits and food and drink intake frequency.

Statistical methods

Odds ratios with 95% confidence intervals were used to assess the univariate relationships between variables. Forward stepwise logistic regression analysis was used to identify which variables were best associated with smooth/occlusal surface tooth wear. All dietary variables which showed bivariate association with

erosion were entered into this model as possible predictors, along with age, sex and toothbrushing frequency. SPSS software version 17 was used for statistical analysis, and analysis was performed at the 5% significance level.

Results

Initial kappa values for inter-examiner reliability for the four examiners were in the range of 0.56 to 0.65. These improved after the school calibration exercise to 0.68-0.73. Intra-examiner reliability was not measured in this study.

The total number of children examined and who completed a questionnaire were 629, mean age 13.6 years, of whom 303 (48%) were boys and 326 (52%) were girls. The number of children with exposed dentine was 320 (51%) and without was 309 (49%). By excluding incisal edge and canine tip wear, an indication is given of smooth surface/occlusal wear, deemed to be more reflective of erosive wear, rather than of attrition. After exclusion of incisal edge wear, 124 (20%) children had a minimum of one smooth or occlusal surface with exposed dentine. 114 children (18%) had exposed dentine on the occlusal surface of at least one molar, 18 (3%) had exposed dentine on a palatal surface, and 6 (1%) had exposed dentine on a labial surface. A significantly greater proportion of males (24%) compared to females (16%) had dentine exposed on smooth/occlusal surfaces (odds ratio 2.1, 95% confidence interval 1.1 to 2.4). Older children were also more likely to have dentine exposed on smooth/occlusal surfaces (OR 1.9, 95% confidence interval 1.2 to 3.0).

The distribution of exposed dentine was symmetrical, with a higher prevalence in the mandible compared to the maxilla. Only 8 children had exposed dentine on both occlusal and smooth surfaces. Of these 8 children, 7 consumed fizzy drinks at least once a day.

Bivariate associations between reported consumption of various dietary items (flavoured water, fruit juice, milk, water, fruit, yoghurt, ice cream, chewing gum), and smooth surface/occlusal erosion were mostly non-significant. However, significantly more children having had exposed dentine on smooth/occlusal surfaces when reporting drinking any fizzy drink “once a day or more” compared to the lower frequency of intake (odds ratio 1.6 (95% CI 1.1 to 2.3)). A higher proportion of children who reported twice daily brushing had exposed dentine on smooth/occlusal surfaces (OR 2.1; 95% CI 1.2 to 3.7). Mean DMFT scores were not statistically different for children with smooth surface/occlusally exposed dentine (1.37, s.d. 1.71) compared to those without (1.58, s.d. 2.08).

Stepwise logistic regression analysis was performed on smooth/occlusal surface erosion, with all variables showing a significant bivariate association included as possible explanatory variables (age, toothbrushing, gender, and fizzy drink consumption). All variables with the exception of fizzy drink consumption entered the model. An increase of 1 year in age increased the odds of having erosion by 1.75 times (95% CI 1.10 to 2.78). The odds of a male having erosion were 1.74 times the odds of a female (95% CI 1.15 to 2.62). Brushing teeth twice per day increased the odds by 2.37 times (95% CI 1.31 to 4.29).

Discussion

Attribution of dentinal exposure to a specific factor is problematic. In assessing palatal, labial and occlusal surfaces and not incisal edges, we attempted to evaluate erosion. The assumption that wear on these surfaces is exclusively due to erosion can be erroneous, given that toothbrush abrasion can affect labial surfaces, but this is unlikely to happen in teeth which are not already affected by erosion [Hooper et al., 2003]

51% of children had at least one surface with exposed dentine. This is similar to previous results on prevalence in this age group: 57% [Bartlett et al, 1998], 52% [Al-Dlaigan et al., 2001a], 53% [Bardsley et al., 2004]. Previous studies reported the prevalence of palatal surfaces with exposed dentine to range from 0.5% to 2% [Bartlett et al., 1998; Williams et al., 1999; Al-Dlaigan et al., 2001a], compared to 3% in the present study.

The 15-year-olds sampled in the National Children's Dental Health Survey [Chadwick et al., 2006] showed an increase in Tooth Surface Loss into dentine or pulp on palatal surfaces from 2% in 1993 to 5 % in 2003 (3% in this study). In the NCDH survey, the prevalence of exposed dentine on the occlusal surfaces of molars was 4% compared to 16% in this study, mainly on the lower occlusal surfaces. This result was similar to the 2003 survey [Chadwick et al., 2006] in that lower molars were more frequently eroded through to dentine than upper permanent molars.

A significantly higher proportion of males had exposed dentine on smooth/occlusal surfaces compared to females supporting previous results [Al-

Dlaigan et al., 2001a; Dugmore and Rock, 2004]. This may be because males drink more fizzy drinks than females [Balding, 1992].

Frequent consumption of any fizzy drinks (including diet/regular, flavoured water, fruit juices) showed a bivariate association with erosion, although this variable did not enter the multivariate regression model when other significant factors were included. Although other studies in teenagers have reported correlations between erosion and various dietary factors, these have tended to show only weak to moderate associations [Dugmore and Rock, 2004; Milosevic et al., 1997; Milosevic et al., 2004], have failed to show any association [Bartlett et al., 1998; Williams et al., 1999] or have omitted to report the correlation coefficients [Al-Dlaigan et al., 2001a].

Brushing teeth twice per day increased the odds of erosion in smooth/occlusal surfaces by 2.37, a stronger association than reported in previous research [Al-Dlaigan et al., 2001b]. A marginally significant greater mean DMFT score was found in children with exposed dentine which is similar to one report of a positive association (OR=1.5) between caries and erosion in both the 12 and 14 year old age groups [Dugmore and Rock, 2004b]. Although acidic sugary drinks provide a common risk factor for caries and erosion, the processes are different. In general, surfaces prone to erosion (cusp tips and palatal surfaces) or attrition (incisal edges) are not those where caries occurs.

In conclusion, this cross-sectional epidemiological study has shown greater prevalence of erosion in males compared to females and an increase in the proportion of 13-14-year-old children with exposed dentine in molars compared

to previous studies. The results support the finding of an upward trend identified in the 2003 NCDH survey. The cause for this increase is less obvious. As with previous studies, weak associations between potentially erosive dietary items and smooth/occlusal surfaces with exposed dentine were found. Whether the 13-14-year-old age group is too young to accurately determine causal relationships is debatable. Children on the Isle of Man appear to have similar levels of caries and erosion to their counterparts on the British mainland.

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