

Abstract

Aim: The aim of this paper is to discuss the impact of dietary, educational and behavioural variables on tooth

Keywords: Children; Dental erosion; Tooth erosion; Socioeconomic; Sugary beverages; Oral hygiene

Introduction

Literature has observed that tooth wear erosive lesions were time and behaviour dependent. Tooth surface loss has been largely linked to the high consumption of soft drinks, fruit juices and carbonated drinks [1], with the contribution of dental erosion to tooth wear particularly among children and young adults increasing in prevalence [2]. Careful observation and clinical experience led us to hypothesize a progression of these lesions with time despite dietary counselling and oral hygiene instructions [3].

The role of diet in the aetiology of dental erosion has received the most attention. Dietary acids are undoubtedly the principle causative factor for extrinsic tooth erosion [4]. The consumption of fruits and fruit juices is one of the risk factors most significantly related to this dental hard tissue defect [5]. Early observations in the dental literature on the role of acidic foods in dental erosion date back to Miller [6]. In a study carried out by Milward et al., on Swiss adults it was found that bedtime consumption of fruit juices was strongly associated with the most severe cases of erosion [7]. High rates of erosion were also associated to the consumption of acidic beverages at bedtime by studies carried out by Lewis and Smith [8]. Other abusive or unusual consumption of acidic beverages have been reported to cause severe tooth surface loss. One report described an unusual pattern of dental erosion in a person who had a past habit of holding a cola beverage in his mouth until all the carbonation has dissipated [9]. Another parafunctional habit connected to dental erosion includes swishing concentrated orange or carbonated drink between the teeth before swallowing [10]. Several authors have recommended the drinking of

acidic beverages through a straw introduced into the mouth past the teeth [11]. However, there are case reports that indicate that unusual methods of drinking a flavoured cordial or a fruit drink with a straw caused marked erosion of the anterior teeth [10]. More recently there have been several reports that have raised a concern about an increased prevalence of dental erosion and tooth wear in children. These are mainly related to the recent dramatic increase in the consumption of acidic fruit juices, fruit drinks and carbonated beverages [12]. Also the popular drinks alcopops especially among young females were found to have a highly erosive effect on dental hard tissues due to the fact that they are based on fruits with high citric acid content and also the alcohol content increases the risk of vomiting [13,14].

Järvinen et al. suggest that internal factors, such as disorders with vomiting, regurgitation or reflux of gastric contents, have been crucial in approximately one quarter of all cases of dental erosion [15]. Vomiting is commonly a manifestation of many organic and psychosomatic disorders for example anorexia and bulimia nervosa [16]. Anorexia has

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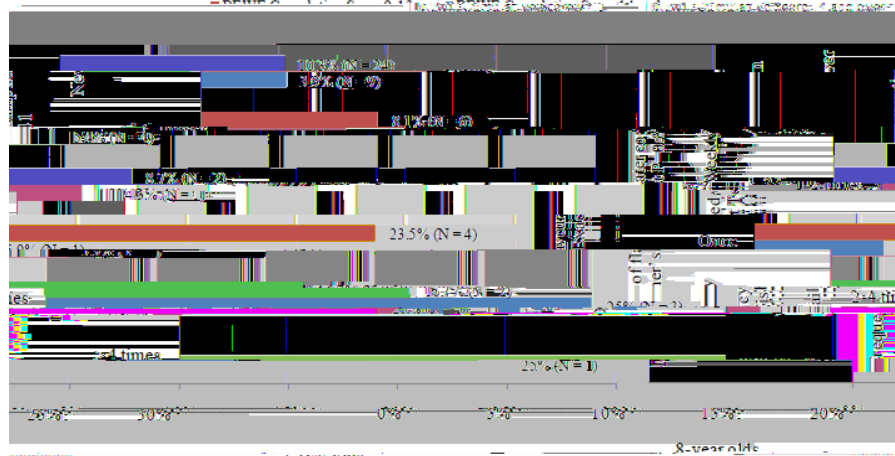


Figure 3: vs. BEWE cumulative score in 8-year olds.

sugary drinks have been observed to classify in the BEWE cumulative scores' "medium and high risk" groups.

Socio-Economic status; and type of school attended

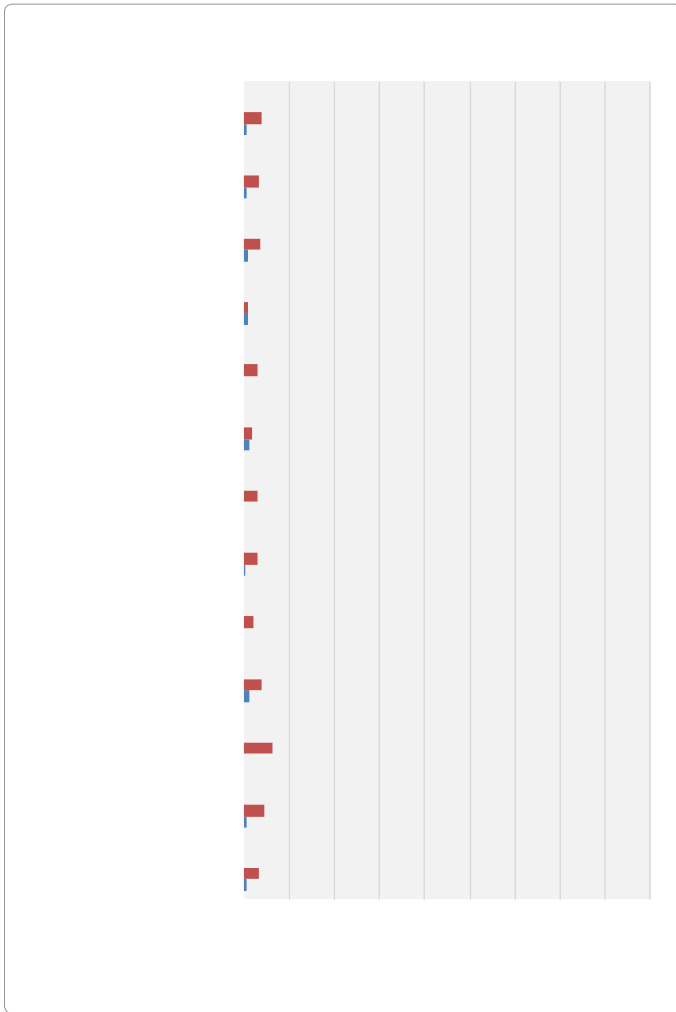
The effect of the level of education of both parents on the incidence of tooth erosion present in their children has been analysed and the resulting relationship was statistically significant using Fischer's Exact test at $p=0.035$ for the 15-year old subjects as represented in Figure 6.

There is a gradual increase in the percentage of subjects at no risk

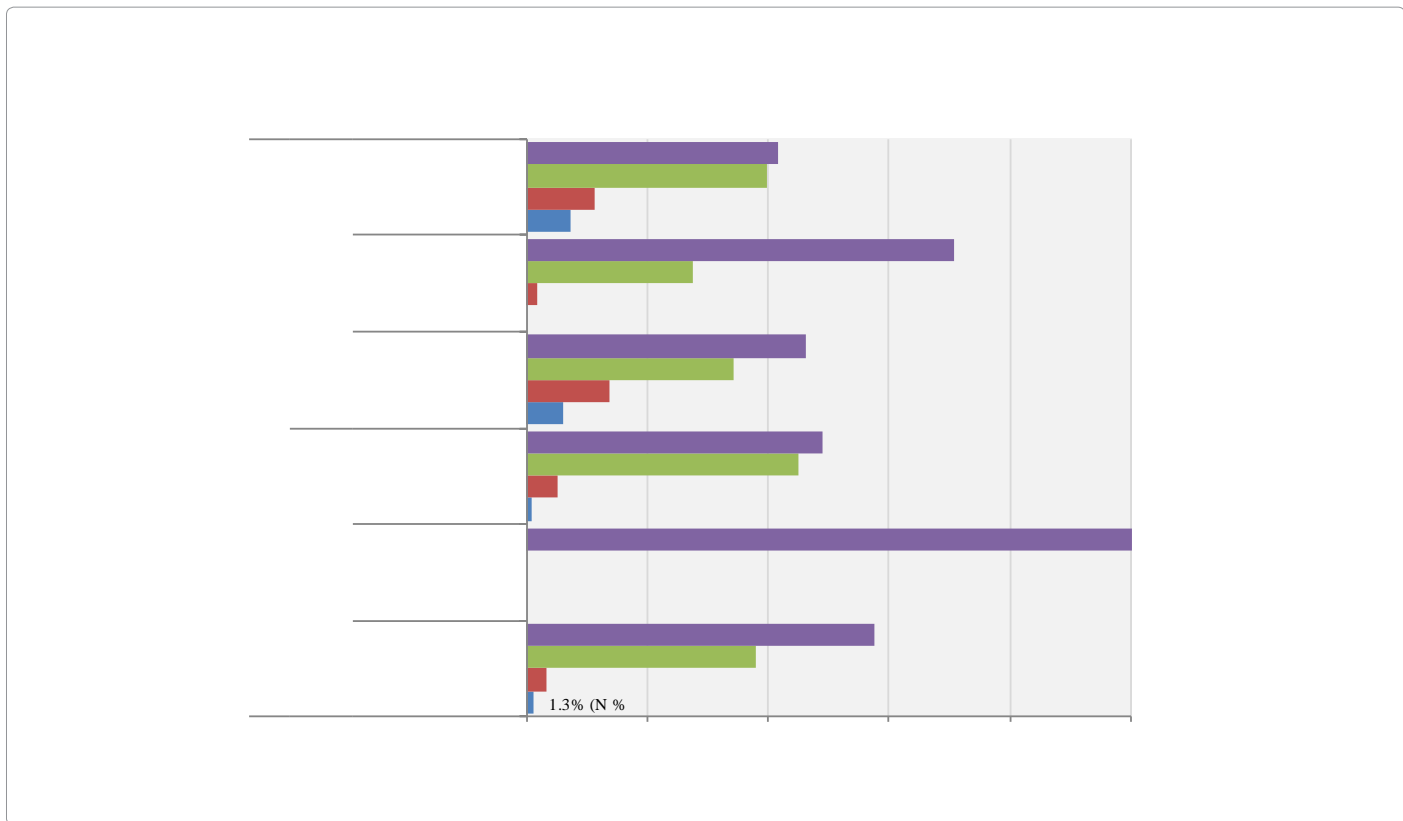
of tooth erosion as the highest level of the mothers' education attained improves from primary school level education to a post-graduate level.

Similarly data collected concerning the main breadwinner of the household for the interviewed subjects revealed a statistically significant relationship between the level of tooth erosion and the occupation of the main breadwinner of the 8-year old subjects' family as presented in Figure 7.

The type of school attended by the subjects was found to be statistically significant for both age groups in relation to the incidence



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between the incidence of tooth erosion and i) the frequency of tooth brushing ($p=0.000$) and ii) the time when the teeth were brushed ($p=0.001$). Of note, a significant majority (63.8%) of 15-year old subjects who brush their teeth before eating breakfast were at the least

risk of tooth erosion compared to 54.9% of the subjects who do not brush their teeth before breakfast.

Furthermore, the type of toothbrush used by the 15-year olds was statistically related to level of tooth erosion and the BEWE score reported.

The majority of 15-year old patients using a soft-bristled (57.4%) or medium-bristled (57.4%) toothbrush were at no risk of tooth erosion. However 15.4% of patients brushing their teeth with a hard-bristled scored a BEWE cumulative score of 9-13, being the highest percentage within the two most severe tooth erosion scores range.

The subjects' use of toothpaste with different fluoride content and the incidence of tooth erosion were explored. Of note, 52.6% and 7.9% of the subjects that did not use adult toothpaste with fluoride were within the BEWE score 3-8 and 9-13 respectively which are relatively high percentage levels compared to subjects using the adult fluoridated toothpaste.

We also explored the reasons for the subjects' most recent dental visit. In the 15-year olds subjects this variable was significantly related to the incidence of tooth erosion observed in the subjects as reported in Figure 10.

Interestingly, 53% of the 15-year olds that have visited the dentist suffering from toothache are within the 3-8 BEWE score group, being the highest percentage of prevalence of this level of tooth erosion compared to subjects visiting the dentist for other reasons.

Multivariate linear regression model

A multivariate linear regression model was carried out for both age groups to identify which the determining factors for the incidence of tooth erosion.

In the 8-year olds group, as presented in Table 6, the three variables that remained statistically significant were BMI, the main breadwinner's employment and brushing technique. Thus tooth erosion in an 8-year old was more likely to be reported for subjects that have a high BMI, whose parents have an unskilled job and brush their teeth in a vertical or horizontal motion as opposed to circular motion.

In a 15-year old subject, the likelihood of tooth wear incidence increased in the subject who attends a public school, whose father

attained a low level of education, whose last visit to the dentist was triggered by a toothache, did not brush the teeth frequently and mostly consumed sugary beverages as reported in Table 7.

Discussion

The most popular acidic drinks consumed by the 8-year olds were fizzy drinks (26.9%), fresh orange juice (16.4%), squashes and iced tea (9.1%) and flavoured water (7.5%) with frequent consumption of the latter linked to a higher incidence of tooth erosion in 8-year olds.

A significant correlation was observed between consumption of fizzy drinks and the BEWE cumulative scores in 15-year olds as reported in Figures 4 and 5. It is indicated that the consumption of these highly erosive drinks should be curtailed. Similar conclusions were drawn by Shaw and Smith [12] who reported a concern on the increased prevalence of dental erosion and tooth wear in children related to the recent drastic increase in the consumption of acidic drinks including carbonated beverages [12]. Accordingly, it can be stated that reducing the consumption of fizzy drinks which are highly erosive drinks would lead to less severe cases of erosion at such young age.

As for the 15-year olds group, the most popular drinks were reported in the following ranking: fizzy drinks (54.8%), hot chocolate (37.1%), tea and coffee with sugar (48.1%), fresh orange juice (46.1%), packaged juice (21.4%), squashes or iced tea (24.5%), flavoured water (16.0%) and sports drinks (25%).

A statistical significant correlation was observed between the incidence of tooth erosion and the consumption of fizzy drinks, hot chocolate, packaged juice, squashes, iced tea, flavoured water, sports drinks, herbal tea, liquid centred bubble gum, crisps, throat lozenges, vinegar and red or white wine. The risk of tooth erosion increased along with an amplified consumption of the before-mentioned acidic consumables. Despite the fact that 15-year olds are under the legal age limit to purchase and consume alcohol, a number of them still reported consumption of alcohol such as wine. Such ease of access to

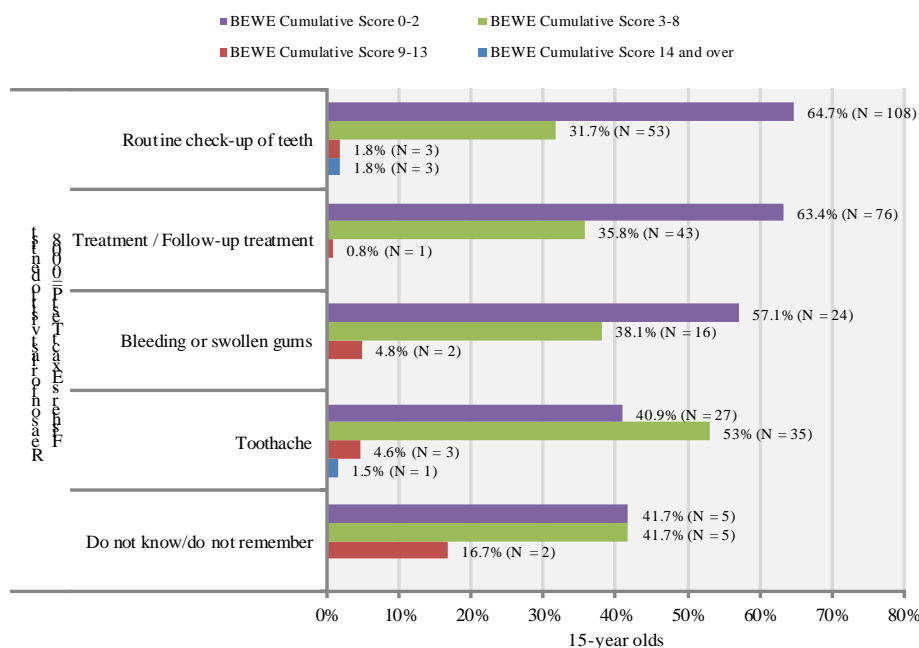


Figure 10: Reason for most recent visit to dentist vs. incidence of tooth erosion in 15-year olds.

Variable	Unadjusted		Adjusted	
	Effect	p-Value	Effect	p-Value
Type of School	+	0.002	/	>0.050
BMI (categorized)	+	0.003	+	0.041
Parents' job	-	0.035	-	0.001
Brushing motion	+	0.070	+	

A statistically significant correlation between the parents' level of education and the incidence of erosion in the 15-year olds group highlighted lower erosion scores at higher education levels. In the 8-year olds group a statistically significant relation was observed between the job of the main breadwinner and the incidence of erosion, with the incidence of erosion increasing as the job held changes from a professional or managerial nature to unskilled work or unemployment.

This is consistent with the literature presented by Harding et al. and Dugmore and Rock identifying a link between low socioeconomic status and the occurrence of dental erosion [36,37].

Results from this epidemiological study showed that students in both age groups attending independent schools were at a lower risk of tooth erosion compared to students attending state and church schools.

This finding is of particular interest since the curriculum of all schools includes considerable activities relevant to the promotion of oral health awareness. Therefore there is a need to establish if the promotional activities are effective and also further investigations into the additional factors contributing to this finding should be considered.

Whilst the brushing frequency by the subjects was observed to be similar among the different types of schools in both age groups, there is a noticeable variance in the consumption pattern of acidic food or drinks between students attending independent schools compared to other schools. Subjects within the 8-year olds group attending private independent schools reportedly consumed less fizzy drinks, squashes, iced-tea, flavoured water and sports drinks than their counterparts in the other schools. Similarly, the 15-year olds subjects consumed less fizzy drinks, squashes, iced-tea, hot chocolate, beer, liquid centred bubble gum and crisps.

On the other hand, the study uncovers a higher consumption, by students attending independent schools, of acidic food and drinks usual associated with a healthier life-style such as salad dressing in both age groups and fresh orange juice, soluble vitamins and cider as an alternative to other alcoholic beverages in the older age group. This important finding can be correlated to the parents' education level and job held which are contributing factors in influencing the dietary habits within the household and is corroborated with the findings whereby on average the parents of the subjects in both age groups attending private independent schools have the highest level of education and occupy jobs of a professional or managerial nature. Though this finding calls for increased oral health education focusing on factors contributing to tooth erosion even amongst the health conscious parents, a lower incidence of erosion was more pronounced in the higher than in the lower educational strata of the population.

The frequency and timing of brushing were particularly relevant contributors to the incidence of erosion in the 15-year old subjects. Statistically, children brushing their teeth twice or more times daily have lower BEWE scores.

A statistical significance was also recorded, for the same age group, for pre- and post-breakfast brushing time and incidence of erosion. The incidence of erosion in 15-year olds was lower for subjects that brush their teeth before breakfast (63.8% BEWE score 0-2) compared to their peers that do not brush their teeth before breakfast (54.9% BEWE score 0-2).

Whilst the above mentioned factors were not statistically significant for the 8-year olds group, a correlation was observed between the use of adult Fluoride-based-toothpaste and a lower risk of tooth erosion for the younger age group. This finding is corroborated by literature

alcohol is in line with the results reported for the Maltese participants in a study commissioned by the European Union in 2011 where over 12,000 randomly selected young people aged 15-24 were interviewed across the 27 EU Member States and the vast majority (80%) of the Maltese respondents thought that it would be preferable for them to obtain alcoholic drinks [35].

Although mineral water was the preferred beverage consumed by the majority of respondents in both age groups, it was observed that a number of subjects customarily consume acidic beverages during the day or whilst participating in sports activities.

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