

IN BRIEF

- The aims of this study were, first to describe the dental history and oral hygiene practices in a cluster random sample of 14-year-old children in Birmingham UK. Secondly, to determine whether the oral hygiene practices are related to dental erosion.
- Data on the dental history and oral hygiene practices were obtained from a self-reported questionnaire supplemented by a structured interview to 418 children (209 male, 209 female).
- Oral hygiene practices in teenage school children in Birmingham, UK complied with generally recommended guidelines.
- There was a relationship between dental erosion and some of these oral hygiene practices.
- Advice concerning the impact of some oral hygiene procedures needs to be given to those who are susceptible to dental erosion.

Dental erosion in a group of British 14-year-old, school children.

Part III: Influence of oral hygiene practises

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Objectives The aims of this study were firstly to describe the dental history and oral hygiene practises in a cluster random sample of 14-year-old children in Birmingham, UK. The second aim was to determine whether the oral hygiene practises are associated with dental erosion.

Method A total of 418, 14-year-old schoolchildren from a cluster random sample in Birmingham, UK were assessed for dental erosion (209 males and 209 females). Data on the dental history and oral hygiene practises were obtained from a self-reported questionnaire supplemented by a structured interview. The data were analysed using SPSS with Mann-Whitney *U* analyses and odds ratios.

Results 74% of the teenagers claimed to attend the dentist on a six-monthly basis; 60% brushed their teeth twice a day ie before breakfast and last thing at night, 25% once a day, 12% three times or more a day and 3% less than once a day. It was also found that 28% of the children brushed their teeth after meals; 92% of the children used a manual toothbrush and 56% of them replaced their toothbrush every three-months. The most common technique used by the children was a circular brushing movement; 44% of them used a mouthwash and 40% used other interdental cleaning. Girls brushed their teeth more frequently than boys. Associations were found between dental erosion and brushing teeth last thing at night, after meals, techniques of brushing teeth, and type of toothbrush and frequency of brushing.

Conclusion It was concluded that reported oral hygiene practises in teenage schoolchildren in Birmingham, UK complied with generally recommended guidelines. However, there was an association between dental erosion and some of these oral hygiene practises. Advice concerning the impact of some oral hygiene procedures needs to be given to those who are susceptible to dental erosion.

The first and second parts of this study investigated the prevalence of dental erosion and possible relationships with socio-economic group and the influence of dietary intake. This third part concerns other extrinsic factors that may also have an

impact on the prevalence of tooth wear involving dental erosion.

There have been several European investigations¹⁻⁵ concerning toothbrushing frequency in children but the data collection and sampling methods were very different and do not allow direct comparison. However, Honkala *et al.*⁶ surveyed 11-13 and 15-year-old adolescents in 11 European countries and reported the highest brushing frequency in Sweden; 98% of these children brushed daily compared with the lowest levels in Spain, where only 68% of children brushed daily. Kuusela *et al.*⁷ described the oral hygiene habits of 11-year-old schoolchildren in 22 European countries and Canada. This was part of a WHO Collaborative Study based on data collected during 1993-1994. They observed the most favourable habits in Sweden, Denmark, Germany, Austria and Norway where between 73% and 83% of children brushed their teeth twice daily. At the other end of the spectrum 26%-33% of boys from Finland, Lithuania, Russia, Estonia and Latvia brushed twice daily or more. This extensive study concluded that there were considerable differences in toothbrushing frequency among children in European countries.

Toothbrushing frequency varies with gender and socio-economic background of children⁸⁻⁹ and also appears to be influenced by a number of lifestyle factors.¹⁰ Regis *et al.*¹¹ stated that toothbrushing frequency in adolescents increases with increasing self-esteem.

Toothbrushing and oral hygiene practises are obviously to be encouraged in order to maintain oral health, but they may be a contributing factor to tooth wear involving dental erosion. Several studies¹²⁻¹⁷ have shown that loss of tooth substance after exposure to citrus juices or acidic drinks is accelerated by toothbrushing.

Toothbrushing after every meal could theoretically play a major role in the development of tooth wear involving erosion if the food and drink consumed contained acidic substances. Recently, Jaeggi and Lussi¹⁸ investigated toothbrush abrasion on enamel previously exposed to a standardised artificial erosive agent. The enamel was exposed to citric acid solution for 3 minutes followed by toothbrushing for 0, 30 and 60 minutes. The tooth tissue loss was significantly lower following 60 minutes exposure to the oral environment than immediately after acidic exposure.

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However, toothbrushing is normally carried out using toothpaste and conversely there may be advantages in the use of a toothpaste, particularly its fluoride content and potential to promote remineralisation following acidic challenge. Munoz *et al.*¹⁹ undertook a laboratory investigation of the effects of a conventional and a remineralizing toothpaste on the hardness of enamel following acidic soft drink exposure. They concluded that toothpaste could be effective in inhibiting damage due to soft drink consumption. Nevertheless the abrasives in toothpastes may exacerbate tooth wear after exposure of the dentine to acid and differences in abrasivity between various toothpastes products may lead to a spectrum of effects.

Therefore, oral hygiene practises, particularly the time and frequency of toothbrushing and usage of toothpaste, can influence the development of erosion following acid consumption. However, there is some conflicting evidence relating acid challenge and toothbrushing habits. Further information is consequently needed not only to describe the dental and oral hygiene practices in the child population, but also to try to quantify other possible related and causative factors.

AIMS AND OBJECTIVES

The aims of this study were firstly to describe the dental history and oral hygiene practises in a cluster random sample of 14-year-old children in Birmingham, UK. The second aim was to determine whether their oral hygiene practises were associated with dental erosion.

MATERIALS AND METHODS

A cluster random sample of 14-year-olds was drawn from Birmingham UK, and a total of 418 children were examined; 209 were males and 209 were females. This involved 12 secondary schools covering a very broad range of social and ethnic mix. Details of the sample selection are given in Part I of this study.²⁰ The numbers of children examined in each school differed according to the size of the school. They and their parents/carers gave informed consent to participate in this study and ethical approval was given by the Birmingham Research Ethics Committee.

All the children were examined clinically within their schools under standard illumination from a Daray light using number 6 plane mouth mirrors. The surfaces of all teeth present in the mouth were scored for dental erosion according to the criteria based on the Tooth Wear Index of Smith and Knight,^{21,22} with minor modifications. Extensive calibration and reproducibility exercises in the use of this index were undertaken.

The questionnaire was developed to cover dental history and oral hygiene practises that were used by the children. These included dental attendance (every six months, once a year and only when in pain); frequency of toothbrushing (less than once a week, less than once a day, once a day, twice a day, three times a day and more than three times a day); time of toothbrushing (always after a meal, sometimes after a meal, last thing at night, before breakfast and last thing at night and other); the techniques of brushing (from side to side, up and down, in circular movements and all of these techniques); type of toothbrush (manual, electric and both); replacement of toothbrush (every 3 months, every 6 months and more than 6 months); the use and type of toothpaste, mouthwash and any interdental cleaning.

The questionnaire was piloted in three studies carried out in the Unit of Paediatric Dentistry at the University of Birmingham Dental School and Hospital. Following modification of both questions and format, it was finally re-tested on another group of 35 teenagers.

After undertaking the clinical examination, the data were collected through a self-reported questionnaire completed by the

Table 1. Dental history and oral hygiene practises used by the children.

Dental and oral hygiene history	Number of Children	% of Children
a. Attending a dentist:		
Every six months	310	74
Once a year	41	10
Only when in pain	67	16
b. Toothbrushing after meals		
	117	28
c. Type of toothpaste		
Colgate	77	18
Colgate Total	98	23.5
Aquafresh	52	12.5
Macleans	30	7
Own brands (Sainsbury, Boots, etc)	17	4
Crest	3	0.7
Whitener	6	1.3
Sensodyne	8	2
Signal	5	1.3
Ultradrite	3	0.7
Others	7	2
More than one kind	112	27
d. Type of toothbrush		
Manual	384	92
Electric	23	5
Both	11	3
e. Replacing toothbrush		
Every 3 months	232	56
Every 6 months	163	39
More than 6 months	23	5
f. Other oral hygiene practices		
Mouthwash	185	44
Anything to clean between the teeth	167	40

children at the schools. As there was a wide range of educational attainment, some children required help to undertake this through a structured interview with standardised prompts.

All data were analysed using SPSS with Mann-Whitney *U* analyses and odds ratios and confidence intervals for the explanatory factor. Significance was accepted at the $p < 0.05$ level.

RESULTS

The results showed that the majority of children (74%) visited their dentist on a regular basis every six months. Ten percent of the children visited the dentist once a year and 16% of the children attended the dentist only when they had pain (Table 1).

The majority of children (92%) used a manual toothbrush, with only 5% using an electric toothbrush and 3% using both manual and electric. As far as toothbrush replacement was concerned, 56% replaced their toothbrush every 3 months, 39% every 6 months and 5% replaced their brush very infrequently. Other oral hygiene practises were also investigated: 44% of the children used a mouthwash and 40% claimed to use some form of interdental cleaning.

Ten percent of the children brushed three times daily, 60% brushed their teeth twice a day and 25% brushed once a day. Only 2% of the children stated that they brushed their teeth less than once a day (Figure 1). It was also important to investigate the time of day when toothbrushing was undertaken; 60% of children

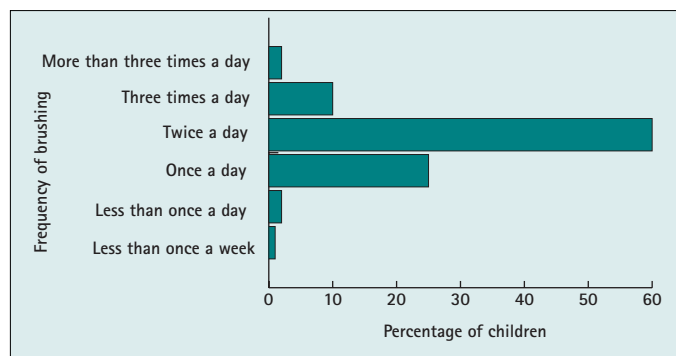


Figure 1 Frequency of brushing used by children.

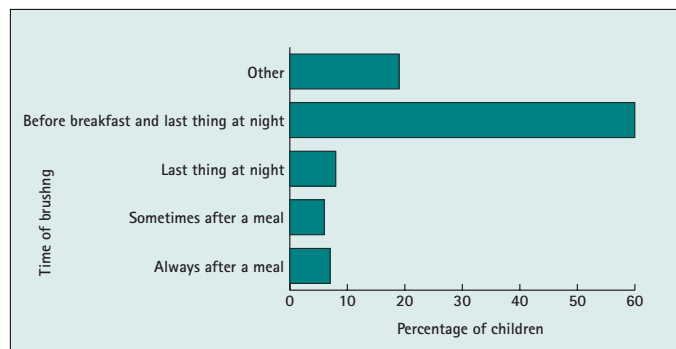


Figure 2 Time of day brushing undertaken by children

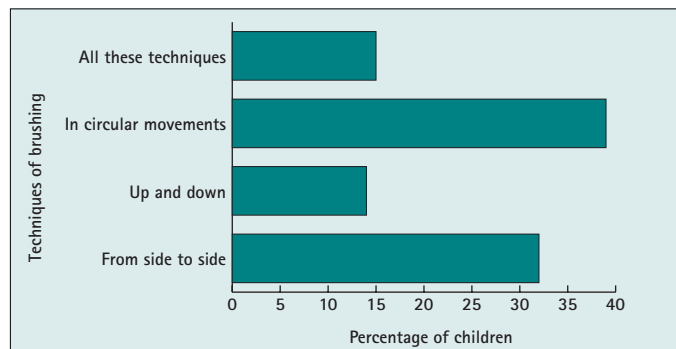


Figure 3 Toothbrushing technique used by children

claimed to clean their teeth before breakfast and last thing at night, with a further 8% just at night (Figure 2). Toothbrushing techniques were variable, although 39% of these children stated that they cleaned their teeth with a circular motion (Figure 3).

The children were asked about what type of toothpaste they used after listing some of the common toothpaste available in the market. It was found that 41.5% of the children were using Colgate or Colgate Total and less than 31.5% of the children were using a different type of toothpaste such as Aquafresh, Macleans, Own brands, Crest, Whitener, Sensodyne, Signal, Ultrabrite, and other. It was also found that 27% of the children were using more than one product from these types of toothpaste at the same time (Table 1).

Analysis of dental history and oral hygiene practises was also undertaken by gender and is shown in Table 2. Females were more likely to attend the dentist than males. There were highly significant differences between males and females ($p < 0.0001$, Mann-Whitney *U* test) in the frequency of toothbrushing; more females (70%) brushed their teeth twice a day compared with males (49%). However, there were no significant differences between genders in the periodicity of toothbrushing or types of toothpaste etc.

The possible association between erosion and the questionnaire data was analysed by allocating the children on an individual basis into either the low erosion group or the moderate/severe erosion group. Table 3 shows the odds ratios and confidence intervals for

Table 2. Differences of dental history and oral hygiene practises analysed by gender using Mann-Whitney *U* analyses

Dental and oral hygiene history	Males		Female		Significance P value	
	Number	%	Number	%		
a. Attending a dentist:						
Every six months	151	72	159	76	0.408	
Once a year	24	12	17	8		
Only when in pain	34	16	33	16		
b. Frequency of brushing teeth						
Less than once a week	4	2	0	0	0.0001	
Less than once a day	9	4	2	1		
Once a day	71	34	32	15		
Twice a day	103	49	147	70		
Three times a day	19	9	23	11		
More than three times a day	3	2	5	3		
c. Time of brushing teeth						
Always after a meal	11	5	15	7	0.508	
Sometimes after a meal	13	6	11	5		
Last thing at night	24	11	19	4		
Before breakfast and last thing at night	121	58	134	64		
Other	40	19	40	19		
d. Brushing teeth after meal						
	54	26	63	30	0.256	
e. Type of toothpaste						
Colgate	36	17	41	20	0.632	
Colgate Total	43	21	55	26		
Aquafresh	32	15	20	10		
Macleans	20	10	10	5		
Own brands (Sainsbury, Boots)	8	4	9	4		
Crest	2	1	1	0.5		
Whitener	3	1.5	3	1.5		
Sensodyne	5	2	3	1.5		
Signal	2	1	3	1.5		
Ultrabrite	2	1	1	0.5		
Others	3	1.5	4	2		
More than one kind from these types	53	25	59	28		
f. Techniques of brushing teeth						
From side to side	71	34	61	29		0.461
Up and down	30	14	28	13		
In circular movements	74	36	90	43		
All these techniques	34	16	30	15		
g. Type of toothbrush						
Manual	191	91	193	92	0.674	
Electric	11	5	12	6		
Both	7	4	4	2		
h. Replacing toothbrush						
Every 3 months	124	59	108	52	0.184	
Every 6 months	73	35	90	43		
More than 6 months	12	6	11	5		
i. Other oral hygiene practices						
Mouthwash	85	41	100	48	0.199	
Anything to clean between the teeth	81	39	86	41	0.750	

dental history and oral hygiene practises, which were associated with dental erosion. Each of the variables showing no difference at all between low and moderate/severe erosion or with odds ratios value below 1 was eliminated from the table in order to simplify it. There was an association between increasing levels of dental erosion and children brushing their teeth last thing at night (OR = 3.17). This was the only association that was shown to be statistically significant. However no significant trends with odds ratios of more than 1.5 towards increasing erosion were shown with the type of toothbrush and brushing after meals.

DISCUSSION

The present study provides a considerable amount of information from this random sample of 14-year-olds with regard to dental history and oral hygiene practises. It also enabled these to be assessed as potential risk factors in relation to dental erosion.

Regular dental attendance has been encouraged in the United Kingdom; the current investigation showed that three-quarters of these teenagers visited the dentist regularly, whereas 16% of them only attended when in pain. This is very similar to the data presented in the Child Dental Health Survey⁴ which reported that 77% of 15-year-olds were regular dental attendees. Peterson²³ and Evans *et al.*²⁴ have shown that oral health behaviour and dental attendance are highly influenced by the educational levels of their parents and there is thus a higher attendance rate in those from higher socio-economic groups.

This is also apparent in toothbrushing habits. Many published studies have considered frequency of toothbrushing both in the UK and in other European countries.¹⁻⁷ In the UK Child Dental Health Survey, O'Brien⁴ found that 13% of 15-year-olds brushed their teeth three or more times daily, 67% twice daily, 17% once daily and 3% less often than daily; these findings are somewhat higher than in the current study. The comparable figures were 12% brushing three times daily, 60% twice daily and 27% brushed once per day or less. There were highly significant gender differences with girls more likely to brush their teeth; this is in agreement with other studies (MacGregor *et al.*,¹⁰ Dummer *et al.*²⁵). The time of brushing could also conceivably affect the development of erosion, particularly if this was undertaken immediately after meals or last thing at night following an acidic drink. The present investigation has shown that one third of children brushed their teeth after a meal, but of those children brushing twice daily, 60% brushed before breakfast and last thing at night. O'Brien⁴ reported that 80% of children brushed before bedtime. The majority of children used a manual toothbrush with a range of fluoride toothpastes and a cir-

cular movement. Almost half of them claimed to use a mouthwash. Some studies^{9,26-29} have indicated that toothbrushing behaviour is associated with several factors such as social class, gender, and number of children in the family and these may influence the frequency of toothbrushing or oral hygiene in general. All these studies are based on reported toothbrushing behaviour rather than observed behaviour and as such may be considered higher values; however there should be comparability between the studies.

Associations were found between dental erosion and brushing last thing at night, after meals, toothbrushing technique and type of toothbrush. It should however, be noted that in the current investigation there were numerous variables and multiple tests of significance. The possibility, therefore, always exists of spurious results that may have occurred by chance. Nevertheless, these findings clearly highlight a number of interesting points in relation to dental erosion and oral hygiene practises. They also give clinical confirmation of the *in vitro* experiments undertaken by Jaeggi and Lussi¹⁸ and Davis and Winter.³⁰ There appears to be some evidence from the current study relating the type of toothpaste to erosion (see odds ratios Table 3). It is possible that the abrasive content of toothpaste can be more important than fluoride levels. However, caution may be required in considering associations between type of toothpaste and erosion, since it was not possible to determine the duration of use of the reported type of toothpaste and 27% of children regularly used more than one kind of toothpaste.

Nevertheless, there are some potentially contradictory findings in the present investigation. For example, girls brushed more frequently than boys and in general had what would be accepted as better oral hygiene practises; overall, the levels of erosion were lower in girls. Toothbrushing and dental attendance were more frequent in higher socio-economic groups, but again there was less erosion in children from higher socio-economic groups. These apparent anomalies suggest that there is a very complex relationship between oral hygiene practises, other aetiological factors, and erosion; other potential causes of erosion such as diet may be of more importance.

Thus, in conclusion, this study has described some of the dental history and oral hygiene practises used by teenagers in Birmingham, UK. Some significant differences have been shown in relation to gender. In addition, oral hygiene practises were shown to be associated with the development of dental erosion. This is an area that requires further investigation as it is apparent that some practises traditionally regarded as desirable in the prevention of most oral disease may require modification in those who are shown to be susceptible to the development of dental erosion.

Table 3. Odds ratios and confidence intervals for dental history and oral hygiene practises: variables associated with dental erosion.

Variables	216 (52%) Moderate/severe erosion group Number of children	202 (48%) Low erosion group Number of children	Odds ratio OR	95% CI for OR
1. Brushing teeth last thing at night	25	8	3.174	1.397 – 7.213
2. Type of toothbrush (Manual)	202	182	1.586	0.778 – 3.231
3. Time of brushing teeth (always after a meal)	16	10	1.536	0.680 – 3.468
4. Brushing teeth after meals	69	48	1.506	0.977 – 2.320
5. Brushing teeth in circular movements	92	72	1.340	0.903 – 1.988
6. Anything to clean between the teeth	92	75	1.256	0.848 – 1.861
7. Type of toothpaste (Colgate)	43	34	1.228	0.747 – 2.020
8. Type of toothpaste (Colgate Total)	54	44	1.197	0.760 – 1.885
9. Attending a dentist every six months	163	147	1.151	0.742 – 1.783
10. Brushing teeth three times a day	23	19	1.148	0.605 – 2.178
11. Brushing teeth once a day	55	48	1.096	0.702 – 1.712
12. Replacing toothbrush every 3 months	122	110	1.085	0.738 – 1.597
13. Type of toothpaste (Macleans)	16	14	1.074	0.510 – 2.262

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