Scientific Article

Common Dental Conditions Associated With Dental Erosion in Schoolchildren in Australia

Stauros Kazoullis, BDSc, MDSc[1] • W. Kim Seow, BDS, MDSc, PhD, DDSc[2] • Trevor Holcombe, BDSc, B Comm, Grad Cert Clin Dent[3]
Bruce Newman, BDSc, Grad Cert Clin Dent[4] • Daniel Ford, BSc, BDSc[5]

Abstract: *Purpose: The purpose of the investigation was to determine factors associated with dental erosion in a group of schoolchildren in Queensland, Australia. Methods: Dental examinations were carried out on 714 children aged 5.5 to 14.6 years from 8 randomly selected Australian schools. A total of 3,165 primary and 2,976 permanent teeth were scored for dental erosion using a modified erosion index. Dental caries experience was determined from clinical examination and bite-wing radiographs. Enamel defects were recorded using the developmental defects of enamel index. Results: There were 225 children (32%) who exhibited no erosion and 489 (68%) who had erosion of at least one tooth. Erosion was found in 78% of subjects with primary teeth and 25% of subjects with permanent teeth (P<.001). Children with erosion in the primary and permanent dentition were more likely to have: (1) a lower socioeconomic status (primary dentition, P<.001 and permanent dentition (P<.001); (2) enamel hypoplasia in permanent dentition (P=.001); (3) dental caries in the primary dentition (P=.001); and (4) permanent dentition (P=.002). Conclusions: In Australian schoolchildren, the prevalence of dental erosion in the primary dentition is approximately 3 times greater than in the permanent dentition. Dental erosion is strongly associated with caries experience and enamel hypoplasia. (Pediatr Dent 2007;29:33-39)*

KEYWORDS: DENTAL EROSION, PREVALENCE, CARIES, ENAMEL HYPOPLASIA, PRIMARY DENTITION, PERMANENT DENTITION

In recent years, dental erosion is increasingly recognized as an important cause of tooth structure loss in children. Erosion is commonly due to an intrinsic acid source such as gastrointestinal reflux or extrinsic acids such as carbonated soft drinks.[1] Tooth changes observed in dental erosion range from mild modification of surface characteristics to severe loss of tooth structure.[2-8] Clinical problems associated with erosion include: (1) dental sensitivity; (2) altered esthetics; (3) enamel fracture; and (4) eating difficulties.[2-8]

Although studies on dental erosion in children are available from Europe,[2-4] Saudi Arabia,[5,6] the United States,[7] and China,[8] data from Australian children are lacking. Furthermore, there are few studies regarding dental erosion in the primary dentition. As primary teeth have thinner enamel and dentin,[9-11] it is hypothesized that they are more susceptible to dental erosion.[12]

In addition, predisposing factors for dental erosion remain unclear. While one study has demonstrated that there may be more dental erosion in males compared to females,[13] others have shown no significant gender differences.[7] Furthermore, children with dental caries may also be more predisposed to dental erosion,[6,14,15] suggesting that there may be common risk factors in the two conditions.

The purpose of the present study was to establish the prevalence of dental erosion in a group of schoolchildren in Queensland, Australia, and to investigate the correlation of dental erosion with other common dental conditions, such as caries and enamel hypoplasia.

Methods

This study was approved by the Human Research Ethics Committee of the University of Queensland and Queensland Health, Brisbane, Australia. A total of 714 children between 5.5 and 14.6 years old, who attended school dental clinics in the Logan-Beaudesert Health Service District in the state of Queensland, Australia, were examined within a 6-month period. This Health Service District—which provides free government dental care through the school dental clinics to over 50,000 schoolchildren—is one of the largest in the state. Children in years 1, 3, and 7 from 8 schools were randomly selected to determine erosion prevalence in the primary, mixed, and early permanent dentitions.[17] The randomization process was achieved by selecting schools in the routine rotational basis for dental examination of the children

[1]Dr. Kazoullis is a specialist pediatric dentist in private practice in Brisbane, Australia; [2]Dr. Seow is associate professor in Pediatric Dentistry, and Drs. [3]Holcombe, [4]Newman, and [5]Ford are currently in the Pediatric Dentistry Program, all in the School of Dentistry, University of Queensland, Brisbane, Australia.
Correspond with Dr. Seow at k.seow@uq.edu.au

Table 1. DEMOGRAPHY OF 5.5- TO 14.6-YEAR-OLD SUBJECTS SHOWING PREVALENCE OF EROSION REGARDING GENDER AND SOCIOECONOMIC STATUS

	All Teeth No. (%)				Primary Teeth No. (%)				Permanent Teeth No. (%)			
	Erosion absent	Erosion present *	Total	P value †	Erosion absent	Erosion present *	Total	P value †	Erosion absent	Erosion present *	Total	P value †
Gender												
Boys	110 (31%)	244 (69%)	354	.87	64 (23%)	218 (77%)	282	.79	225 (71%)	92 (29%)	317	.0345 (Chi-square =4.469, df=1)
Girls	115 (32%)	245 (68%)	360		58 (21%)	213 (79%)	271		326 (78%)	93 (22%)	419	
Total	225 (32%)	489 (68%)	714		122 (22%)	431 (78%)	553		551 (75%)	185 (25%)	736	
Socioeconomic Status												
Lower	112 (29%)	276 (71%)	388	.11	45 (16%)	236 (84%)	281	<.001 (Chi-square = 12.150, df=1)	236 (68%)	111 (32%)	347	.0002 (Chi-square = 13.443, df=1)
Higher	113 (35%)	213 (65%)	326		77 (28%)	195 (72%)	272		296 (80%)	74 (20%)	370	
Total	225 (32%)	489 (68%)	714		122 (22%)	431 (78%)	553		532 (74%)	185 (26%)	717	

* Erosion present in at least one tooth (inclusive of all grades of erosion).

† Chi-square test.

until the required numbers for each age group was obtained. Every child in each year group selected was included in the study unless there was withdrawal of consent from the parent. Signed, informed consent was obtained by 87% of parents/guardians of the schoolchildren contacted.

Clinical examinations were carried out by four examiners, who were calibrated for interexaminer consistency using duplicate examination of a series of extracted primary and permanent teeth which contained the various grades of erosion. Calibration in the field was not performed.

The children were examined in the school dental clinic using a dental mirror and explorer. Teeth were dried prior to examination. Bitewing radiographs were exposed for all subjects as part of the clinical examination. Sixteen key teeth—all permanent first molars, all primary first and second molars, and maxillary permanent central and lateral incisors—were scored for dental erosion.

Dental erosion was scored on a spectrum of increasing severity, from score 0 to 3, using an index proposed by Aine et al.[19,20] In this index:

1. Score 1=loss of surface enamel or rounded cusps.
2. Score 2-dentin was involved in less than one third of the tooth surface.
3. Score 3=dentin involvement was greater than one one third of the tooth surface. The occlusal/incisal, facial, and lingual surfaces were scored for each key tooth.
4. Score 0=normal or no loss of surface enamel anatomy.

The highest score given to a tooth surface was used to assign an erosion grade for each tooth. An erosion index was then calculated for each subject using the erosion grade for each tooth, divided by the total number of teeth scored. No substitutions were made if teeth were not present. Severe erosion is diagnosed if the erosion index is 1.06 or greater.

All teeth present were also examined for the presence and severity of enamel defects using the modified developmental defects of enamel index.[21] In brief, an enamel opacity was scored if there was a change in the translucency of the enamel, and enamel hypoplasia was scored if the enamel was absent in the form of grooves, pits, or missing enamel.[21]

Dental caries was assessed using data combined from the clinical examination and bitewing radiographs to compute the DMFS score for permanent teeth or the equivalent dmfs score for primary teeth for each subject.

The occlusion for each subject was recorded using Angle's classification:

1. Class I=normal;
2. Class II=maxillary molars in mesial occlusion; and
3. Class III=maxillary molars in distal occlusion.

Incisal overjet and overbite were measured using a millimeter scale.[22]

The children's socioeconomic status (SES) was determined from local census data which uses suburb of residence

as well as the occupation of the main income earner in the household to determine socioeconomic status.[23]

Statistical analysis

Data was entered into a custom database and analyzed using Chi-square tests and an alpha significance level of .05. Cohen's Kappa statistic was used to assess interexaminer consistency.[18]

Results

Interexaminer consistency. There was substantial agreement among the examiners for assessment of dental erosion (unweighted kappa=0.76).

Demography and prevalence of erosion. Based on the erosion scores, 2 groups of subjects were identified according to whether they had "erosion absent" or "erosion present." In Table 1, "erosion present" denotes the presence of erosion of any degree of severity in at least one tooth. The "erosion absent" group represented children with an erosion index of 0 (no erosion scored on any teeth) and served as a control group for children with erosion. As shown in Table 1, the population sample of 714 subjects consisted of 354 boys and 360 girls whose ages ranged from 5.5 to 14.1 years. Of all the subjects examined, 225 (32%) exhibited no erosion and 489 (68%) showed erosion of at least one tooth (Table 1). Furthermore, as shown in Table 1, the prevalence in the primary dentition is 78% and in the permanent dentition 25% ($P<.001$).

Compared to permanent teeth, primary teeth showed a higher prevalence of severe erosion (78% vs 14%; $P<.001$). When the children were divided into two socioeconomic groups,[23] subjects in the "erosion present" groups in the respective primary and permanent dentitions groups were significantly more likely to belong in the lower socioeconomic groups ($P<.001$ for primary teeth, $P<.001$ for permanent teeth) compared to the "erosion absent" group (Table 1).

In Table 2, the "erosion present" group represented children with an erosion index greater than or equal to 1.06. When the "erosion absent" group was compared to the "ero-

Table 2. ANALYSIS OF THE ASSOCIATION OF CARIES, ENAMEL HYPOPLASIA, AND OCCLUSION WITH EROSION INDICES OF 5.5- TO 14.6-YEAR-OLD SUBJECTS

	Erosion by index: All teeth No. (%)				Erosion by index: Primary teeth No. (%)				Erosion by index: Permanent teeth No. (%)			
	Erosion absent*	Erosion present†	Total	*P* value	Erosion absent*	Erosion present†	Total	*P* value	Erosion absent*	Erosion present†	Total	*P* value
Occlusion												
Class I	68 (41%)	98 (59%)	166	.11	102 (47%)	115 (53%)	217	.36	132 (53%)	115 (47%)	247	.09
Class II	49 (53%)	44 (47%)	93		73 (55%)	60 (45%)	133		81 (61%)	52 (39%)	133	
Class III	4 (67%)	2 (33%)	6		1 (50%)	1 (50%)	2		9 (82%)	2 (18%)	11	
Overjet *												
≤3 mm	103 (48%)	111 (52%)	214	<.001 (Chi-square = 72.158, df=1)	148 (53%)	132 (47%)	280	.10	179 (57%)	134 (43%)	313	.69
>3 mm	199 (86%)	33 (14%)	232		31 (41%)	44 (59%)	75		42 (53%)	37 (47%)	79	
Enamel hypoplasia												
Present	35 (32%)	73 (68%)	108	.003 (Chi-square = 13.262, df=1)	82 (49%)	87 (51%)	169	.39	65 (43%)	87 (57%)	152	<.001 (Chi-square = 19.285, df=1)
Absent	87 (55%)	71 (45%)	158		98 (52%)	89 (48%)	187		158 (65%)	84 (35%)	242	
Caries												
Present	91 (44%)	115 (56%)	206	.38	41 (32%)	86 (68%)	127	<.001 (Chi-square = 26.388, df=1)	95 (42%)	130 (58%)	225	.002 (Chi-square = 9.858, df=1)
Absent	31 (52%)	29 (48%)	60		139 (61%)	90 (39%)	229		49 (63%)	29 (37%)	78	
Total	121 (46%)	144 (54%)	265		176 (50%)	176 (50%)	352		222 (57%)	169 (43%)	391	

* The criterion for erosion absent is an erosion index of 0.

† The criterion for erosion present is an erosion index of ≥1.06.

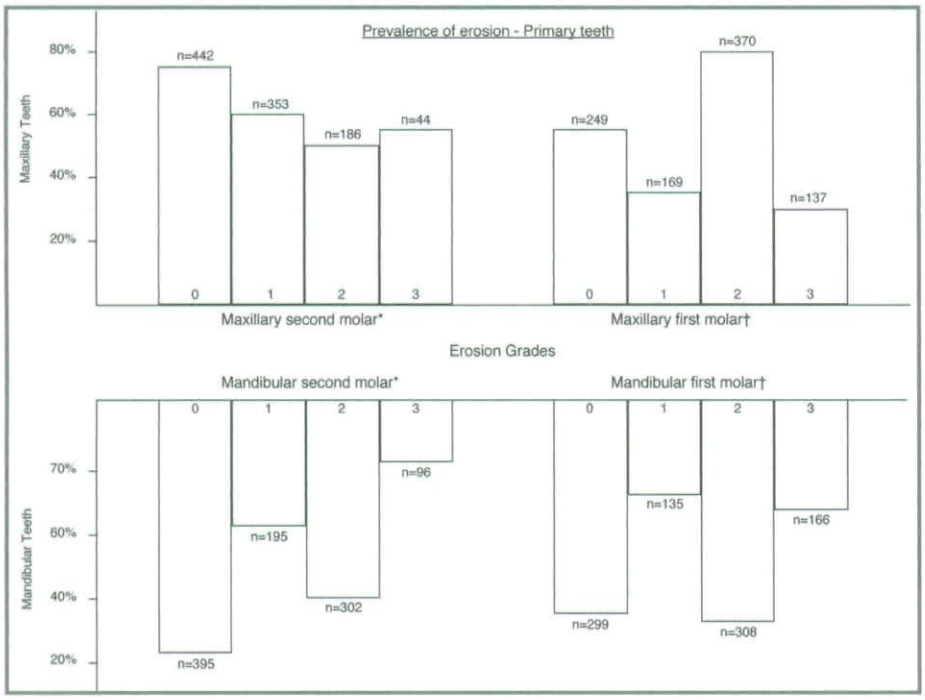

Figure 1. Prevalence by erosion grades in primary teeth.

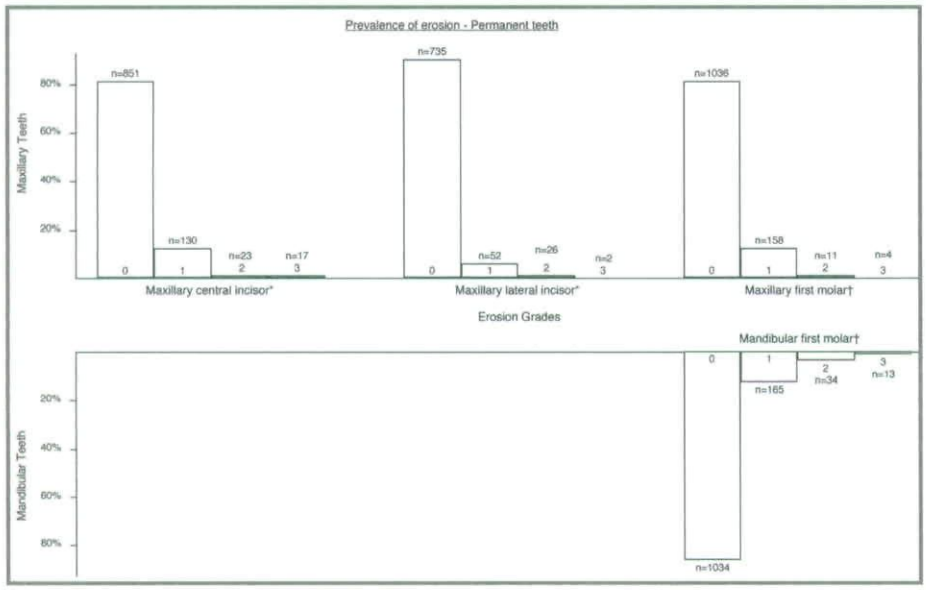

Figure 2. Prevalence by erosion grades in permanent teeth.

sion present" group, there was no relationship found between the groups and type of occlusion (Class I, II, or III) in the permanent dentition (Table 2). Children with erosion present, however, were more likely to have an anterior overjet of greater than 3 mm ($P<.001$; Table 2).

Figures 1 and 2 show the prevalence by erosion grades in primary and permanent teeth, respectively. As shown in Figure 1, when the individual teeth (N=8,138 teeth) were analyzed by their individual erosion grades, it was observed that the primary maxillary molars were significantly more likely to have severe erosion compared to mandibular molars ($P<.001$). On the other hand, in the permanent dentition, the maxillary lateral incisors were significantly more likely to have moderate to severe erosion compared to maxillary central incisors ($P<.001$; Figure 2). Also, mandibular permanent first molars were more likely to have severe erosion compared to maxillary permanent first molars ($P<.001$; Figure 2).

Analysis of the association of erosion with enamel hypoplasia. To determine the association of enamel hypoplasia with erosion, the children were grouped as having: (1) "enamel hypoplasia present"; or (2) "enamel hypoplasia absent" (Table 2). As shown in Table 2, children with enamel hypoplasia were more likely to also have severe dental erosion in the permanent dentition ($P<.001$), but not in the primary dentition.

To examine whether enamel hypoplasia and/or dental erosion were found on the same teeth, individual teeth were grouped as having "erosion absent" or "erosion present" and as "enamel hypoplasia present" or "enamel hypoplasia absent," respectively. As shown in Table 3, for permanent teeth scored (N=4,291 teeth), individual permanent teeth with erosion were more likely to also have enamel hypoplasia ($P=.007$). No significant relationship, however, was observed in the primary teeth (Table 3).

Analysis of association of erosion with dental caries. To examine the effects of caries and dental erosion in the subjects, the children were grouped as having "caries present" or "caries absent," respectively. As shown in Table 2, children with caries present were more likely to also have severe dental erosion in the primary dentition ($P<.001$) as well as in the permanent dentition ($P=.002$).

When individual teeth were grouped into "caries pres-

ent" and "caries absent" (Table 4), the permanent teeth with caries present were significantly more likely to also belong to the "erosion" group (P=.001). On the other hand, there was no significant relationship between the caries and erosion in individual primary teeth (NS).

Discussion

Loss of tooth structure is thought to result from the processes of erosion, attrition, or abrasion.[24-26] Erosion is a chemical dissolution of the dental hard tissues by intrinsic and extrinsic acids while abrasion is the physical wear of teeth resulting from mechanical grinding, rubbing, scraping, or microcutting by objects other than another tooth.[24-26] On the other hand, attrition usually describes the physical wear induced by tooth-to-tooth contact, with no foreign substance intervening.[26] Although the processes of erosion, abrasion, and attrition may be defined separately, however, loss of tooth structure in an individual is usually the result of a combination of all three processes. In most cases of severe tooth wear, erosion is thought to be the main contributory process, while attrition and abrasion are of lesser significance.[27,28] Erosion softens the enamel—which, in turn, renders a tooth surface more susceptible to wear by abrasive mechanical agents.[27]

To the best of the authors' knowledge, this study is the first to investigate the prevalence of dental erosion in Australian schoolchildren. The overall prevalence of 68% of dental erosion found in the present study is high compared to previous studies of similar-aged children conducted in:

1. the United Kingdom, which reported a prevalence of 24% to 30%[2];

Table 3. ANALYSIS OF THE ASSOCIATION OF ENAMEL HYPOPLASIA WITH EROSION IN INDIVIDUAL TEETH

	Erosion absent No. (%)	Erosion present No. (%)	Total No. (%)	P value*
Primary teeth				
Enamel hypoplasia present	1,293 (36%)	2,291 (64%)	3,584	.77
Enamel hypoplasia absent	92 (35%)	171 (65%)	263	
Total	1,385 (36%)	2,462 (64%)	3,847	
Permanent teeth				
Enamel hypoplasia present	3,240 (86%)	539 (14%)	3,779	.007 (Chi-square = 7.200, df=1)
Enamel hypoplasia absent	416 (81%)	96 (19%)	512	
Total	3,656 (85%)	635 (15%)	4,291	
All teeth				
Enamel hypoplasia present	4,533 (62%)	2,830 (38%)	7,363	.029 (Chi-square = 4.721, df=1)
Enamel hypoplasia absent	508 (66%)	267 (34%)	775	
Total	5,041 (62%)	3,097 (38%)	8,138	

* Chi-square test used for analysis.

Table 4. ANALYSIS OF THE ASSOCIATION OF CARIES WITH EROSION IN INDIVIDUAL TEETH

	Erosion absent No. (%)	Erosion present No. (%)	Total No. (%)	P value*
Primary teeth				
Caries present	1,338 (54%)	1,124 (46%)	2,462	.70†
Caries absent	743 (54%)	642 (46%)	1,385	
Total	2,081 (54%)	1,766 (46%)	3,847	
Permanent teeth				
Caries present	508 (80%)	127 (20%)	635	.001 (Chi-square = 32.509, df=1)
Caries absent	3,226 (88%)	430 (12%)	3,656	
Total	3,734 (87%)	557 (13%)	4,291	
All teeth				
Caries present	1,846 (60%)	1,251 (40%)	3,097	.001 (Chi-square = 344.14, df=1)
Caries absent	3,969 (79%)	1,072 (21%)	5,041	
Total	5,815 (71%)	2,323 (29%)	8,138	

* Chi-square test used for analysis.

2. Saudi Arabia, with a prevalence of 25% to 26%[5,6]; and
3. the United States, with a prevalence of 41%.[7]

These varying prevalences among the different populations could be related to differences in consumption of acidic beverages as well as the different criteria used to define erosion lesions. In addition, the relative numbers of children in the various age groups studied can also influence the results, as prevalence rates increase with the children's ages. For example, a recent study on 3- to 5-year-old children reported a very low prevalence of only 0.9%,[8] while studies on teenagers usually yield a higher prevalence of over 30%.[7,8]

The high prevalence of dental erosion in the present study is associated with particular demographical and dental risk factors. Children from the relatively lower socioeconomic groups demonstrated a higher risk to dental erosion, suggesting higher consumption of acidic drinks in these groups.[13] It is probable that lower educational levels and less awareness of the dangers of acidic drinks in the lower socioeconomic groups could account for their higher predisposition to dental erosion.[29] Other studies, however, have not shown similar correlation of socioeconomic status with dental erosion.[13,14]

The present study also demonstrated that erosion in the primary dentition is more severe compared to the permanent dentition. This increased risk of the primary teeth to erosion could have resulted from several factors. First, it is possible that the pattern of mineralization is different in primary teeth, which may render the enamel more liable to dissolution by acids.[11] Second, the enamel is less thick in primary teeth compared to permanent teeth, so that the erosion process may reach dentin more rapidly in primary teeth. Third, with respect to ages of children studied in the present investigation, the primary teeth have been in the mouth for a longer period of time, which could have led to greater amounts of tooth structure loss.

Developmental defects of the enamel and dental caries were found to be strongly associated with dental erosion in the present study. Enamel defects may be expressed clinically as opacities (hypomineralization) or as reduced or absent enamel (hypoplasia).[30] The present results showed that enamel defects were also present in the same teeth with erosion, suggesting that abnormal enamel development may be a risk factor for dental erosion. The authors hypothesize that the reduced or altered mineralization observed in enamel defects may lead to greater ease of dissolution by acids and secondary tooth structure loss through attrition and abrasion.

On the other hand, the relationship between dental caries and erosion observed in the present study may be more complex. As both diseases are caused by acids, it is likely that oral conditions favoring one disease also favor the other. In this regard, Linnett and Seow[1] have reported that there are higher levels of the cariogenic bacteria mutans streptococci in children at risk of dental erosion from gastrointestinal reflux. In addition, loss of protective factors such as saliva can place a child at risk to both diseases.[31,32] Also, acidic soft drinks containing large amounts of sugar are likely to predispose the patient to both erosion and dental caries.[33]

Conclusions

Based on the results of this study, which was limited to Australian schoolchildren, the following conclusions can be made:

1. Dental erosion is a common finding in the primary dentition, with a frequency three times that of the permanent dentition.
2. Children of lower socioeconomic status groups are at increased risk for dental erosion.
3. Dental erosion is associated with enamel hypoplasia in the primary dentition and with both enamel hypoplasia and dental caries in permanent dentition.

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References

1. Linnett V, Seow WK. Dental erosion in children: A literature review. Pediatr Dent 2001;23:37-43.
2. O'Brien M. Children's Dental Health in the United Kingdom 1993. London, UK: Her Majesty's Stationery Office; 1994.
3. Dugmore CR, Rock WP. The prevalence of tooth erosion in 12-year-old children. Br Dent J 2004;196:279-82, discussion 273.
4. Ganss C, Klimek J, Giese K. Dental erosion in children and adolescents—a cross-sectional and longitudinal investigation using study models. Community Dent Oral Epidemiol 2001;29:264-71.
5. Al-Majed I, Maguire A, Murray JJ. Risk factors for dental erosion in 5- to 6-year-old and 12- to 14-year-old boys in Saudi Arabia. Community Dent Oral Epidemiol 2002;30:38-46.
6. Al-Malik MI, Holt RD, Bedi R. Erosion, caries, and rampant caries in preschoolchildren in Jeddah, Saudi Arabia. Community Dent Oral Epidemiol 2002;30:16-23.
7. Deery C, Wagner ML, Longbottom C, Simon R, Nugent ZJ. The prevalence of dental erosion in a United States and a United Kingdom sample of adolescents. Pediatr Dent 2000;22:505-10.
8. Luo Y, Zeng XJ, Du MQ, Bedi R. The prevalence of dental erosion in preschoolchildren in China. J Dent 2005;33:115-21.

9. Seow WK, Young WG, Tsang AKL, Daley T. A study of primary dental enamel from preterm and fullterm children using light and scanning electron microscopy. Pediatr Dent 2005;27:374-9.
10. Sumikawa DA, Marshall GW, Gee L, Marshall SJ. Microstructure of primary tooth dentin. Pediatr Dent 1999;21:439-44.
11. Wilson PR, Beynon AD. Mineralization differences between human deciduous and permanent enamel measured by quantitative microradiography. Arch Oral Biol 1989;34:85-8.
12. Ohrn R, Angmar-Mansson B. Oral status of 35 subjects with eating disorders—a 1-year study. Eur J Oral Sci 2000;108:275-80.
13. Milosevic A, Young PJ, Lennon MA. The prevalence of tooth wear in 14-year-old schoolchildren in Liverpool. Community Dent Health 1994;11:83-6.
14. Al-Malik MI, Holt RD, Bedi R. The relationship between erosion, caries, and rampant caries and dietary habits in preschoolchildren in Saudi Arabia. Int J Paediatr Dent 2001;11:430-9.
15. Dugmore CR, Rock WP. A multifactorial analysis of factors associated with dental erosion. Br Dent J 2004;196:283-6, discussion 273.
16. Boston DW, al-bargi H, Bogert M. Abrasion, erosion, and abfraction combined with linear enamel hypoplasia: A case report. Quintessence Int 1999;30:683-7.
17. Cohen JA. Statistical Power Analysis for the Behavioral Sciences. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.
18. Cohen JA. A coefficient of agreement for nominal scales. Educ Psychol Meas 1960;20:37-46.
19. Aine L, Baer M, Maki M. Dental erosions caused by gastroesophageal reflux disease in children. J Dent Child 1993;60:210-4.
20. Smith BG, Knight JK. An index for measuring the wear of teeth. Br Dent J 1984;156:435-8.
21. A review of the developmental defects of enamel index (DDE Index). Commission on Oral Health, Research & Epidemiology. Report of an FDI Working Group. Int Dent J 1992;42:411-26.
22. Angle, EH. Treatment of the Malocclusion of the Teeth: Angle's System. 7th ed. Philadelphia, Pa: The SS White Dental Manufacturing Company; 1900.
23. Queensland Department of Local Government and Planning. Demographic Profile: Logan-Beaudesert Health. Canberra, Australia: Australian Bureau of Statistics; 2001.
24. Pindborg J. Pathology of Dental Hard Tissues. Copenhagen, Denmark: Munksgaard; 1970.
25. Bell EJ, Kaidonis J, Townsend G, Richards L. Comparison of exposed dentinal surfaces resulting from abrasion and erosion. Aust Dent J 1998;43:362-6.
26. Smith B. Tooth wear: Aetiology and diagnosis. Dent Update 1989;16:204-12.
27. Young WG. The oral medicine of tooth wear. Aust Dent J 2001;46:236-50, quiz 306.
28. Johansson AK. On dental erosion and associated factors. Swed Dent J Suppl 2002;6:1-77.
29. Al-Dlaigan YH, Shaw L, Smith A. Dental erosion in a group of British 14-year-old schoolchildren. Part II: Influence of dietary intake. Br Dent J 2001;190:258-61.
30. Seow WK. Enamel hypoplasia in the primary dentition: A review. J Dent Child 1991;58:441-52.
31. Young WG, Khan F. Sites of dental erosion are saliva-dependent. J Oral Rehabil 2002;29:35-43.
32. Hicks J, Garcia-Godoy F, Flaitz C. Biological factors in dental caries: Role of saliva and dental plaque in the dynamic process of demineralization and remineralization (part 1). J Clin Pediatr Dent 2003;28:47-52.
33. Seow WK, Thong KM. Erosive potential of common beverages. Aust Dent J 2005; 50:173-8.