
Non-carious dental conditions

**Children's Dental Health in the United Kingdom,
2003**

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The 2003 Children's Dental Health Survey

The 2003 Children's Dental Health Survey, commissioned by the four United Kingdom Health Departments, is the fourth in a series of national children's dental health surveys that have been carried out every 10 years since 1973 in England and Wales and in the whole of the UK since 1983.

The survey provides information on the dental health of children in the United Kingdom, measures changes in oral health since the last survey in 1993 and provides information on children's experiences of dental care and treatment and their oral hygiene.

The 2003 survey was based upon a representative sample of children aged 5, 8, 12 and 15 years of age attending government maintained and independent schools in the UK. A total of 12698 children were sampled within participating schools and asked to take part in a dental examination at school. In total 10381 children were examined, a response rate of 82%. Background data on children's oral hygiene and dental care and were requested by questionnaire from the parents of a random sub-sample of 5480 examined children. In total, 3342 questionnaires were returned, a response rate of 61%.

Details of the survey methodology can be found in the Children's Dental Health in the United Kingdom 2003 Technical Report available at <http://www.statistics.gov.uk/children/dentalhealth/>

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The examinations took place in schools. Local Education Authorities, headteachers and school staff gave their help and co-operation in the administration of the study. Most importantly, thanks go to the children who were examined, and the parents who completed questionnaires about their children's dental background.

Particular acknowledgement goes to Jan Gregory (1946–2003) for her considerable contribution to the series of adult and children's dental health surveys, as well as a wide range of other ONS surveys.

Notes on the tables and text

Proportionately larger samples were selected in Wales and Northern Ireland than in England to provide estimates for these three countries within the UK. The data needed to be reweighted in order to produce representative figures for the UK as a whole. Weighted bases are provided for UK estimates and unweighted sample sizes are provided for individual country comparisons.

There was no oversampling in Scotland relative to England as a separate analysis for Scotland was not required by the Scottish Executive.

Differences cited in the text are statistically significant ($p < 0.05$) unless otherwise stated.

A dash in a table indicates a zero value, while an asterisk indicates a proportion of less than 0.5% or a mean of less than 0.05.

Figures presented in parentheses [] indicate a low base number of respondents and results are indicative only.

Introduction

Tooth Surface Loss (TSL) is pathological non-carious loss of tooth tissues resulting from

- chemical action not involving bacteria (erosion), or
- wear due to tooth-to-tooth contact during mastication or grinding of teeth (attrition) or
- physical wear caused by factors other than tooth-to-tooth contact, for example toothbrushing (abrasion).

Erosion appears to be the major cause of TSL in childhood and adolescents. Amongst this group abrasion is relatively uncommon. In contrast attrition is common, particularly in the primary dentition with almost all incisors showing some signs by the time they exfoliate. While erosion may be the predominant process, attrition and abrasion may compound the problem.

The 1993 Child Dental Health Survey used the term "erosion" but because a single causative process is difficult to determine, the term "tooth surface loss" is considered more appropriate and has been used in the 2003 survey. In addition to TSL on primary and permanent upper incisors, which were reported in 1993, TSL on the occlusal surfaces of first permanent molars are reported in 2003.

The calibration exercise did not include TSL. However, evaluation of the data collected during the training weeks showed that examiners had low levels of agreement in the case of enamel TSL. This was also noted in the 1993 survey. It is suggested that this variation should be taken into account when the results of this chapter are considered. TSL into dentine and dental pulp are easier to identify, and are more important to identify from a management perspective.

When anterior teeth were examined for TSL only buccal and lingual surfaces were scored, the incisal edges were not scored for wear though they were scored for trauma where appropriate.

Alterations to the structure of enamel during its formation produces changes in its appearance which can be observed clinically. The aetiology of these changes is variable and includes trauma, infections and nutritional disturbances, including the ingestion of too much fluoride. The appearance of the tooth varies widely from discrete white or yellow patches (demarcated opacity) to more extensive coverage with fine white lines barely visible to the naked eye (diffuse opacity). More rarely, pitting of the tooth surface occurs (hypoplasia). The defects may appear alone or in combination. Where the opacities are considered unsightly, treatment may be required to improve the appearance of teeth.

In 2003 there were a number of differences in the data collection compared to 1993. Firstly, only the upper incisors, canines and first premolars of 12-year-olds were considered and the lower first permanent molars were not examined. In addition the symmetry of diffuse defects was examined. Finally, the impact of

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diffuse defects was determined by reference to a standard photograph regarded as the level at which diffuse defects cause aesthetic concern.

As in 1983 and 1993, the survey assessed evidence of accidental damage to permanent incisors and treatment undertaken to repair the damage. In the 2003 survey, however, only children aged 8, 12 and 15 were examined in this respect.

Tooth surface loss of primary upper incisors

The proportion of 5-year-olds with evidence of TSL on one or more of the buccal surfaces of the primary upper incisors was 20%, and 3% had TSL involving dentine or pulp. This was similar to that found in 1993 (18% and 1% respectively).

TSL of the lingual surface was more common, affecting over half (53%) of 5 year olds. TSL progressing to dentine or pulp was present on 22% of lingual incisal surfaces. Again, this was similar to the 1993 findings.

Table 1

Table 1 Proportion of 5 year old children with tooth surface loss (TSL) on the surfaces of the primary incisors (United Kingdom, 1993, 2003)

	Any TSL	Into dentine or pulp
<i>Percentage of children with TSL on:</i>		
Incisors		
<i>Buccal surfaces</i>		
1993	18	1
2003	20	3
<i>Lingual surfaces</i>		
1993	52	24
2003	53	22

Table 2 details the TSL on each of the incisors on the left side of the mouth (figures were identical for the right side which is therefore not shown). The proportion of children in 2003 with any TSL was greater on the central incisor (upper left a) than on the lateral incisor (upper left b) for both buccal and lingual surfaces. This differs from 1993 when the level of any TSL for buccal and lingual surfaces was similar on both incisors. As in 1993, TSL into dentine or pulp was greater on the lingual surfaces of the central incisor than the lateral incisor (20% as compared to 11% for the same surface of the lateral incisor), while similar levels of TSL into dentine or pulp were observed on buccal surfaces of each incisor.

Table 2

Non-carious dental conditions**Table 2** Tooth surface loss (TSL) on primary teeth in the left side of the mouth in children aged 5 (United Kingdom, 1993, 2003)

	1993	2003
<i>Percentage of children:</i>		
Buccal surfaces		
<i>Upper left a</i>		
Any TSL	15	17
Into dentine or pulp	1	2
<i>Upper left b</i>		
Any TSL	14	13
Into dentine or pulp	*	1
Lingual surfaces		
<i>Upper left a</i>		
Any TSL	46	52
Into dentine or pulp	20	20
<i>Upper left b</i>		
Any TSL	43	42
Into dentine or pulp	10	11
<i>Weighted base</i>	1691	2538

As in 1993, when a primary incisor was affected by TSL usually two thirds or more of the surface was affected

Table 3

Table 3 Area covered by tooth surface loss (TSL) on lingual surface of primary upper left incisors in children aged 5 (United Kingdom, 1993, 2003)

	1993	2003
	%	%
<i>Upper left central</i>		
Less than a third	5	15
A third, but less than two thirds	11	15
Two thirds or more	83	70
Base (100% of children with TSL)	782	1395
<i>Upper left lateral</i>		
Less than a third	1	17
A third, but less than two thirds	2	12
Two thirds or more	96	71
Base (100% of children with TSL)	718	1195

Non-carious dental conditions**Tooth surface loss of permanent upper incisors and first permanent molars**

TSL of permanent incisors was both less common and less severe than that of primary incisors. At age 8, 4% of incisors had some TSL on the buccal surfaces and by age 15 this had increased to 14%. While there has been no increase in the 8 year old group since 1993, there has been a slight increase in buccal TSL among both the 12 and the 15-year-olds.

Table 4

Table 4 Proportion of children aged 8, 12 and 15 with tooth surface loss on the surfaces of the permanent incisors and first permanent molars (United Kingdom, 1993, 2003)

	Age					
	8		12		15	
	1993	2003	1993	2003	1993	2003
	<i>Percentage of children:</i>					
Incisors						
<i>Buccal surfaces</i>						
Any TSL	4	4	9	12	12	14
Into dentine or pulp	*	*	*	*	*	*
<i>Lingual surfaces</i>						
Any TSL	11	14	27	30	27	33
Into dentine or pulp	*	1	1	3	2	5
Molars						
Any TSL	n/a	10	n/a	19	n/a	22
Into dentine or pulp	n/a	*	n/a	2	n/a	4
<i>Weighted base</i>	1694	2599	1502	2689	1129	2556

As in 1993 TSL was more common on the lingual surfaces of the incisors. The proportion of children with TSL of the lingual surfaces increased at each examined age group with 14% of 8 year old and 33% of 15-year-olds affected. Among 15-year-olds there has been a six percentage point increase in the proportion of affected children since 1993. However, as in 1993 very little TSL was into dentine or pulp.

Table 4

The proportion of first permanent molars with TSL on the occlusal surface rose at each age group with 10%, 19% and 22% affected at age 8, 12 and 15 years respectively. There was little TSL into dentine with only 2% of 12-year-olds and 4% of 15-year-olds affected.

Table 4

Table 5 shows the TSL on each of the two incisors on the left side of the mouth. Both the central (upper left 1) and lateral (upper left 2) incisors show similar levels

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of TSL within each age group. Compared to 1993 figures there has been an increase in any TSL for both incisors at all age groups except for the buccal surface of the central incisor at age 8 where there has been no change. Among 15-year-olds, 28% had TSL affecting the lingual surface of upper left central.

Table 5

Table 5 Tooth surface loss (TSL) on individual permanent incisors and first permanent molars on the left side of the mouth in children aged 8, 12 and 15 (United Kingdom, 1993, 2003)

	Age					
	8		12		15	
	1993	2003	1993	2003	1993	2003
<i>Percentage of children:</i>						
Buccal surfaces						
<i>Upper left 1</i>						
Any TSL	3	3	8	10	11	12
Into dentine or pulp	-	-	-	*	-	*
<i>Upper left 2</i>						
Any TSL	2	3	6	8	9	10
Into dentine or pulp	-	-	-	*	-	*
Lingual surfaces						
<i>Upper left 1</i>						
Any TSL	9	12	22	26	23	28
Into dentine or pulp	*	*	1	2	1	3
<i>Upper left 2</i>						
Any TSL	5	8	21	24	23	26
Into dentine or pulp	*	*	1	1	1	3
Molars Occlusal surface						
<i>Upper left 6</i>						
Any TSL	N/a	6	n/a	13	n/a	15
Into dentine or pulp	N/a	-	n/a	*	n/a	1
<i>Lower left 6</i>						
Any TSL	N/a	6	n/a	15	n/a	18
Into dentine or pulp	N/a	*	n/a	2	n/a	3

n/a Molars were not assessed in the 1993 survey

There is an age-related increase in the proportion of children with TSL in the first permanent molar teeth for both the upper and lower left molars. Among both 12 and 15-year-olds the lower molar is slightly more affected than the upper molar. The proportion of affected lower left first permanent molars rose from 6% in 8-year-olds to 18% in 15-year-olds.

Table 5

As with primary incisors, among 12 and 15-year-olds the majority of affected permanent incisors on the left side of the mouth, had tooth surface loss affecting

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two-thirds or more of the tooth surface. However, amongst 8-year-olds, both the central and lateral incisors, when affected by TSL, were more likely to have less than a third of their lingual surfaces affected. The proportion of teeth showing TSL greater than two thirds of the surface area has decreased since 1993 for every incisor at each age. For both upper and lower left permanent molars, on the majority of affected teeth the area covered by TSL was less than one third of the occlusal surface for all ages.

Table 6

Table 6 Area covered by tooth surface loss on the lingual surfaces of the permanent incisors and occlusal surfaces of the first permanent molars on the left side of the mouth in children aged 8, 12 and 15 (United Kingdom, 1993, 2003)

	Age					
	8		12		15	
	1993	2003	1993	2003	1993	2003
Incisors	%	%	%	%	%	%
<i>Upper left central</i>						
Less than a third	16	45	13	21	6	28
A third, but less than two thirds	19	18	18	23	17	21
Two thirds or more	66	37	69	56	77	50
Base (100% of children with TSL)	161	296	335	638	259	586
<i>Upper left lateral</i>						
Less than a third	6	42	2	27	4	31
A third, but less than two thirds	2	30	2	27	5	22
Two thirds or more	92	28	96	46	92	48
Base (100% of children with TSL)	85	161	315	529	256	501
Molars						
<i>Upper left 6</i>						
Less than a third	n/a	86	n/a	79	n/a	70
A third, but less than two thirds	n/a	9	n/a	15	n/a	21
Two thirds or more	n/a	4	n/a	6	n/a	9
Base (100% of children with TSL)	n/a	162	n/a	267	n/a	260
<i>Lower left 6</i>						
Less than a third	n/a	80	n/a	71	n/a	60
A third, but less than two thirds	n/a	11	n/a	19	n/a	23
Two thirds or more	n/a	8	n/a	10	n/a	16
Base (100% of children with TSL)	n/a	154	n/a	313	n/a	320

n/a Molars were not assessed in the 1993 survey

Non-carious dental conditions**Enamel opacities in 12-year-olds**

Overall, just over one third (34%) of the examined teeth had one or more enamel opacity. As in 1993, the defects presenting most often were demarcated and diffuse opacities: 17% and 16% of 12-year-olds respectively had these on one or more teeth. In three per cent of 12-year-olds, one or more tooth exhibited both demarcated and diffuse opacities. Hypoplasia affected few 12-year-olds with two per cent having hypoplasia alone and one per cent hypoplasia in combination with diffuse opacities. Compared with the 1993 survey the proportion of 12-year-olds in the United Kingdom presenting with enamel defects has decreased slightly.

Table 7

Table 7 Proportion of 12 year olds with enamel opacities and other defects of the tooth enamel (United Kingdom, 1993, 2003, upper incisors and premolars)

	Country							
	England		Wales		Northern Ireland		United Kingdom	
	1993	2003	1993	2003	1993	2003	1993	2003
	<i>Percentage of children:</i>							
Demarcated opacity	19	18	15	20	20	24	20	17
Diffuse opacity	20	18	15	9	7	11	19	16
Demarcated and diffuse opacity	3	3	2	2	4	2	3	3
Hypoplasia	1	2	1	1	1	2	1	2
Demarcated opacity and hypoplasia	1	*	1	*	-	1	1	*
Diffuse opacity and hypoplasia	1	1	-	*	-	1	1	1
All three defects	-	*	-	*	-	-	-	*
Other defects	-	-	-	-	-	-	-	-
Any of the above defects	36	35	27	29	27	33	36	34

A higher proportions of 12-year-olds with enamel opacities was found in England (35%) than in Wales (29%). In Northern Ireland 33% exhibited enamel opacities. Children in Northern Ireland were more likely to have demarcated opacities (24%), compared with England (18%). Diffuse opacities were more prevalent among English 12-year-olds (18%) than they were in Wales (9%) or Northern Ireland (11%).

Table 7

Extent of opacities

The vast majority (92%) of demarcated defects covered less than one third of the tooth surface, with 6% covering between one and two thirds of the surface and only 2% extending beyond two thirds of the tooth surface. As in 1993, the diffuse opacities tended to be more extensive than demarcated opacities, but again the

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majority (59%) were confined to less than one third of the tooth surface. Over a quarter (28%) of diffuse opacities covered between one and two thirds of the tooth with 12% affecting more than two thirds of the tooth surface. Over half (54%) of opacities that were both demarcated and diffuse covered between one third and two thirds of the tooth surface, almost a third (32%) of these defects covered less than one third of the tooth and 13% occupied more than two thirds of the tooth surface.

Table 8

Table 8 Tooth surface area covered by different types of enamel opacities (United Kingdom, 1993, 2003, 12 year olds, upper incisors and pre-molars)

	Demarcated		Diffuse		Demarcated & Diffuse	
	1993	2003	1993	2003	1993	2003
	<i>Percentage of children:</i>					
Less than a third	93	92	64	59	56	32
A third, but less than two thirds	5	6	25	28	33	54
Two thirds or more	2	2	11	12	11	13
<i>Total number of teeth with defect (100%)</i>	<i>511</i>	<i>835</i>	<i>634</i>	<i>1369</i>	<i>62</i>	<i>99</i>

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Teeth affected by opacities and hypoplasia

As in 1993, the central incisors were the teeth most likely to be affected by opacities and other defects of enamel, followed by the lateral incisors. The canines and first premolars exhibited similar percentages of affected teeth; in contrast, in 1993, first premolars had slightly higher levels than the canines.

Table 9

Table 9 Opacities on different tooth types (United Kingdom, 1993, 2003, 12 year olds)

Tooth defect	Upper right 4		Upper right 3		Upper right 2		Upper right 1		Upper left 1		Upper left 2		Upper left 3		Upper left 4	
	1993	2003	1993	2003	1993	2003	1993	2003	1993	2003	1993	2003	1993	2003	1993	2003
	<i>Percentage of children:</i>															
Demarcated opacity	2	2	2	3	5	3	8	7	7	8	4	4	3	2	3	2
Diffuse opacity	6	6	5	5	6	8	11	11	10	11	6	8	4	5	6	5
Demarcated and diffuse opacity	*	*	*	*	1	*	1	2	1	1	*	*	1	*	*	*
Hypoplasia	*	*	-	1	*	*	1	*	*	1	*	*	-	*	*	*
Demarcated opacity and hypoplasia	-	-	-	-	*	*	*	*	*	*	*	*	-	*	*	*
Diffuse opacity and hypoplasia	-	*	*	*	*	*	*	*	1	*	*	*	-	*	*	*
Normal	74	78	68	72	84	83	75	76	77	75	86	83	68	74	73	80
Not assessed	18	13	25	19	4	5	4	4	4	4	4	5	24	18	18	12

Symmetry of diffuse defects

The symmetry of diffuse defects was measured for the first time in 2003. Among examined 12-year-olds with diffuse defects in the United Kingdom almost two thirds (65%) are symmetrical, and could fit into a description of defects attributable to fluorosis. The proportion of symmetrical defects was highest in England, at 66%, with Wales and Northern Ireland having lower levels of 48% and 46% respectively.

Table 10

Table 10 Symmetry of diffuse enamel defects (United Kingdom, 2003, 12 year olds)

	England	Wales	Northern Ireland	United kingdom
	%	%	%	%
Not symmetrical	34	52	53	35
Symmetrical	66	48	46	65
<i>Base (100% of children with defect)</i>	272	54	60	409

Non-carious dental conditions**Impact of symmetrical defects**

The impact of diffuse defects was assessed by reference to a standard photograph regarded as the level at which diffuse defects cause aesthetic concern. Overall, on the teeth examined which had symmetrical diffuse defects, one in ten was found to have a defect more severe than the impact photograph.

*Table 11***Table 11** Severity of symmetrical enamel defects (United Kingdom, 2003, 12 year olds)

	England	Wales	Northern Ireland	United Kingdom
	%	%	%	%
Similar or less severe than photo	89	[98]	[93]	90
More severe than photo	11	[2]	[6]	10
<i>Base (100% of children with defect)</i>	<i>179</i>	<i>28</i>	<i>26</i>	<i>248</i>

[] Caution low base number of respondents - results are indicative only.

Non-carious dental conditions**Parental reports of marks on teeth and enamel opacities**

Questionnaire data is available for a total of 798 12-year-olds who had enamel opacities and whose parents answered the question regarding marks on their children's teeth that could not be rubbed off. A total of 113 parents reported that their children had marks that could not be removed, and 61% of the children had opacities on one or more of their teeth at examination. However, there were also 685 parents who reported that their children did not have marks on their teeth but in 28% of cases the children were found to have one or more opacity at examination.

Parents who reported that their children had marks that could not be removed were also asked if the marks bothered them or their children. Of those who said that the marks were of concern to their children, 72% did have one or more opacity at examination, while of those who said they themselves were concerned by the marks on their children's teeth, 66% had one or more opacity at examination.

Table 12

Table 12 Different types of enamel opacities by parental report of marks on teeth that won't brush off (United Kingdom, 2003, 12 year olds)

	Parental report of marks on teeth that won't brush off		Parental report of whether the marks bother their child			Whether the marks bother the parent	
	Yes	No	Yes	No	Don't Know	Yes	No
	<i>Percentage of children:</i>						
Demarcated opacity	26	15	28	27	11	22	30
Diffuse opacity	33	13	44	29	18	42	20
Demarcated and diffuse opacity	9	2	4	9	18	10	7
Any enamel opacity	61	28	72	59	42	66	54
<i>Base</i>	<i>113</i>	<i>685</i>	<i>38</i>	<i>65</i>	<i>10</i>	<i>66</i>	<i>46</i>

Non-carious dental conditions**The prevalence of accidental damage**

The proportion of children sustaining accidental damage to their incisors increased with age from 5% at age 8 to 13% by age 15. The proportion of children sustaining accidental damage to permanent incisors fell from 1993 among 12 and 15-year-olds. In 1993, 17% of both 12 and 15-year-olds had some accidental damage compared to 11% of 12 year olds and 13% of 15 year olds in 2003. The decline was most pronounced among 12 year old boys, with the proportion having accidental damage falling from 25% in 1993 to 14% in 2003. Among 12 and 15 year olds, boys were more likely to damage their incisors than girls.

Table 13

Table 13 Proportion of children with any accidental damage to the incisors by age, sex and country (United Kingdom 1983, 1993, 2003)

Age	England			Wales			Northern Ireland			United Kingdom		
	1983	1993	2003	1983	1993	2003	1983	1993	2003	1983	1993	2003
<i>Percentage of children:</i>												
Boys												
8	13	6	6	9	7	6	6	6	5	12	6	6
12	29	27	14	31	11	11	22	20	20	29	25	14
15	34	21	17	35	20	14	30	30	23	33	21	16
Girls												
8	7	5	4	6	5	1	5	4	5	7	5	4
12	16	9	7	12	6	7	13	7	10	16	9	8
15	19	12	10	27	11	12	19	25	11	19	12	10
All children												
8	10	6	5	8	6	3	5	5	5	10	6	5
12	23	18	11	22	8	9	18	13	16	23	17	11
15	26	16	13	30	16	13	24	27	17	26	17	13

The trends within countries are, in general, very similar to the United Kingdom pattern with the incidence of dental trauma declining over time for most age groups. The exception is amongst 12-year-olds where there is a slight increase since the 1993 survey from 13% to 16% in Northern Ireland. In both cases the increase is due to an increased incidence of trauma among 12 year old girls.

Table 13

Non-carious dental conditions**Types of damage and treatment**

Table 14 shows different types of accidental damage and treatment. When considering types of damage and treatment to teeth it is important to note that an individual tooth is counted only once. For example, a tooth that has been lost due to trauma and replaced would only be recorded under the "permanent replacement category" not as "missing due to trauma".

The most commonly occurring trauma at all age groups was fracture of enamel. The incidence of this, for all incisors, rose from 4.1 per thousand incisors at age 8 to 10.2 per thousand incisors at age 15. This represents a reduction since 1993 for all age groups; the greatest reduction was for 12-year-olds where the incidence fell from 16.8 per thousand incisors in 1993 to 10 per thousand incisors in 2003.

When upper central incisors alone are considered similar trends emerge. The incidence of enamel fractures was 10.7 per thousand at age 8 rising to 27.7 per thousand at age 12. This is a substantial decrease since 1993 when the incidence was 45.7 per thousand upper central incisors at age 12.

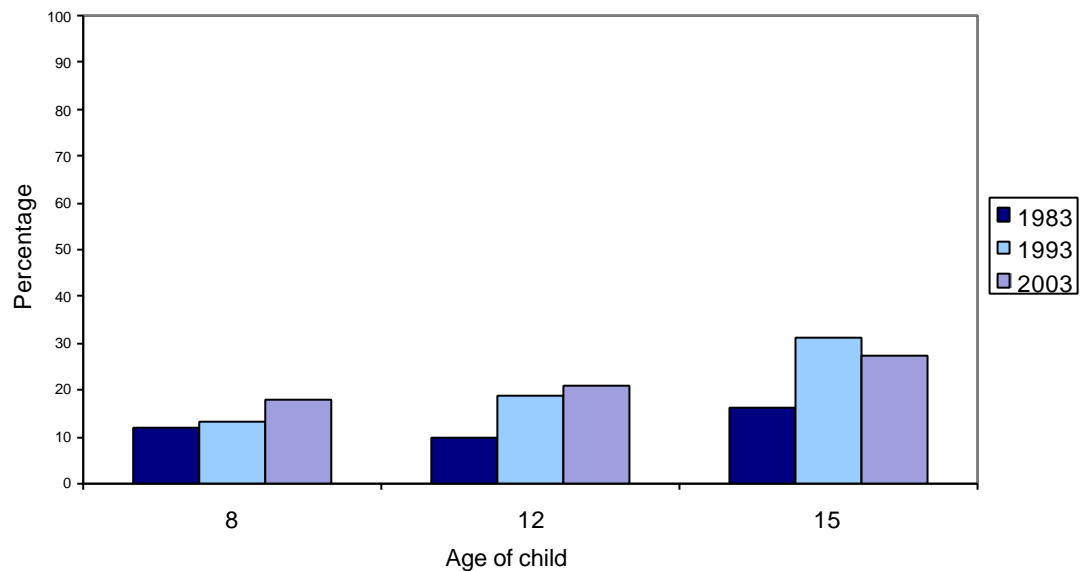
Table 14

Table 14 Rate of different types of accidental damage by age (United Kingdom, 1993, 2003)

	Age					
	8		12		15	
	1993	2003	1993	2003	1993	2003
<i>Rate per thousand incisors:</i>						
<i>All incisors</i>						
Discolouration	0.2	0.2	0.8	0.7	2.1	1.5
Fracture (enamel)	5.4	4.1	16.8	10.0	11.6	10.2
Fracture (enamel and dentine)	3.4	2.0	5.9	2.9	5.0	2.6
Fracture (involving pulp)	0.1	*	0.5	0.1	0.3	0.1
Missing due to trauma	0.1	-	1.1	0.1	0.4	0.2
Acid etch composite	1.4	1.3	5.3	3.4	7.4	4.1
Permanent replacement	-	0.1	0.5	0.2	2.0	1.3
Temporary restoration	-	-	-	*	0.4	-
<i>Rate per thousand upper central incisors:</i>						
<i>Upper Central incisors</i>						
Discolouration	0.6	0.5	2.0	2.3	6.2	3.6
Fracture (enamel)	12.0	10.7	45.7	27.7	32.4	27.6
Fracture (enamel and dentine)	8.6	6.5	8.7	7.9	14.7	5.9
Fracture (involving pulp)	0.3	-	0.7	0.2	0.9	0.4
Missing due to trauma	0.3	-	3.0	0.4	1.8	0.1
Acid etch composite	4.3	4.8	19.3	11.8	24.9	12.8
Permanent replacement	-	0.4	2.0	0.8	7.1	4.7
Temporary restoration	-	-	-	*	1.7	-

Non-carious dental conditions

The majority of traumatized incisors remain untreated, although the percentage that are treated rises with age from 18% treated at age 8 to 27% treated at age 15. At age 8 the proportion of treated incisors has risen slightly in 2003; from 13% in 1993 to 18% in 2003. There is no statistically significant change since 1993 among 12 and 15-year-olds. The relatively low treatment figures are likely to reflect the fact that most injuries are minor enamel fractures which do not always require treatment.

*Figure 1***Figure 1** The proportion of accidental damage to the incisors which had been treated (1983, 1993, 2003)

Appendix A The accuracy of survey results

Sources of error

Like all estimates based on samples, the results of the 2003 Children's Dental Health Survey are subject to variations and errors. The total error associated with any survey estimate is the difference between the estimate derived from the data collected and the true value for the population. The total error can be divided into two main types: random error and systematic error.

Random error

Random error occurs because survey estimates are based not on the whole population but only on a sample of it. There may be chance variations between such a sample and the whole population. If a number of repeats of the same survey were carried out, this error could be expected to average to zero. The size of the sample and the sample design influence the magnitude of these variations due to sampling.

Systematic error

Systematic error is often referred to as bias. Bias can arise because the sampling frame is incomplete, because of variation in the way the dental examination was carried out, or because non-respondents to the survey have different characteristics to respondents. When designing this survey considerable effort was made to minimise systematic error; this included training dental examiners and nurses to reduce variability between them. Nonetheless, some systematic error is likely to have remained, particularly from potential non-response bias, and the data were weighted to reduce any potential non-response bias.

Standard errors and design factors

Statistical theory enables estimates to be made of how close the survey results are to the true population values for each characteristic. A statistical measure of the variation, the standard error, can be estimated from the value obtained for the sample, and provides a measure of the statistical precision of the survey estimate. This allows for a confidence interval to be calculated around the sample estimate which gives an indication of the range in which the true population value is likely to fall. The confidence interval generally used in survey research is the 95% confidence interval; it comprises of approximately two (1.96) standard errors associated with the sample design; they cannot take account of potential errors such as non-response bias or random error due to the misunderstanding of questions.

Non-carious dental conditions

For results based on simple random samples, without clustering or stratification, the estimation of standard errors is straightforward. However, the sample design of the Children's Dental Health Survey was not a simple random sample and therefore a more complex design calculation is needed which takes account of the stratification and clustering of the sample design is necessary. Stratification tends to reduce the standard error, while clustering tends to increase it.

In a complex sample design, the size of the standard error depends on how the characteristic of interest is spread within and between the primary sampling units, and this is reflected in the way the data are grouped in order to calculate the standard error.

Tables A1 to A4 show the standard error and 95% confidence intervals for survey estimates (calculated using STATA, a statistical analysis software package). The tables do not cover all the topics discussed in the report but show a selection of estimates based on information from both the questionnaire and the dental examination. The tables also show the design factor, or deft; the ratio of the complex standard error to the standard error that would have resulted had the survey design been a simple random sample of the same size. This is often used to give a broad indication of the degree of clustering. The size of the design factor varies between survey variables reflecting the degree to which a characteristic is clustered within PSUs, or is distributed between strata. For a single variable the size of the factor also varies according to the size of the subgroup on which the estimate is based, and on the distribution of the subgroup between PSUs and strata. Design factors below 1.0 show that the complex sample design improved on the estimate that would have been expected from a simple random sample, probably due to the benefits of stratification; design factors gained from a simple random sample, due to the effects of clustering.

Table A1 Standard errors and 95% confidence intervals for proportion of 5 year olds with tooth surface loss (TSL) in primary teeth (United Kingdom 2003 and by country)

Characteristic	Percentage (p)	Unweighted sample size	Standard error of p	95% confidence intervals	Deft
Any TSL					
Buccal surfaces	20	2854	2.6	15–25	3.4
Lingual surfaces	53	2854	3.8	46–61	4.0
TSL into dentine or pulp					
Buccal surfaces	3	2854	0.5	2–4	1.7
Lingual surfaces	22	2854	2.1	18–26	2.7

Non-carious dental conditions**Table A2** Standard errors and 95% confidence intervals for proportion of permanent teeth with tooth surface loss (United Kingdom, 2003)

Characteristic	Percentage (p)		Standard error of p	95% confidence intervals	Deft
Buccal Surfaces					
<i>Any TSL</i>					
8 year olds	4	2790	1.0	2-6	3.6
12 year olds	12	2595	2.6	7-17	4.2
15 year olds	14	2142	2.9	8-20	3.9
<i>TSL into dentine or pulp</i>					
8 year olds	*	2790	*	*	0.9
12 year olds	*	2595	*	*	1.2
15 year olds	*	2142	*	*	2.8
Lingual surfaces					
<i>Any TSL</i>					
8 year olds	14	2790	2.4	9-19	3.7
12 year olds	30	2595	4.3	22-38	4.8
15 year olds	33	2142	3.9	25-41	3.9
<i>TSL into dentine or pulp</i>					
8 year olds	*	2790	*	*	1.3
12 year olds	3	2595	0.7	2-4	2.4
15 year olds	5	2142	1.6	2-8	3.5
Molars					
<i>Any TSL</i>					
8 year olds	10	2790	2.4	5-15	4.4
12 year olds	19	2595	4.1	11-27	5.4
15 year olds	22	2142	4.2	14-30	4.7
<i>TSL into dentine or pulp</i>					
8 year olds	*	2790	*	*	1.4
12 year olds	2	2595	0.6	1-3	2.3
15 year olds	4	2142	1.0	2-6	2.4

Non-carious dental conditions**Table A3** Standard errors and 95% confidence intervals for proportion of 12-year-olds with enamel opacities and other defects of the tooth enamel (United Kingdom, 2003, upper incisors and premolars)

Characteristic	Percentage (p)	Unweighted sample size	Standard error of p	95% confidence intervals	Def
Demarcated opacity					
England	18	1356	1.9	14–22	1.8
Wales	20	559	2.1	16–24	1.3
Northern Ireland	24	462	1.6	21–27	0.8
United Kingdom	17	2595	1.6	14–20	2.1
Diffuse opacity					
England	18	1356	2.3	13–23	2.2
Wales	9	559	1.6	6–12	1.3
Northern Ireland	11	462	2.1	7–15	1.4
United Kingdom	16	2595	2.0	12–20	2.7
Demarcated and diffuse opacity					
England	3	1356	0.5	2–4	1.3
Wales	2	559	1.0	0–4	1.6
Northern Ireland	2	462	0.4	1–3	0.8
United Kingdom	3	2595	0.5	2–4	1.6
Hypoplasia					
England	1	1356	0.3	0–2	1.0
Wales	1	559	0.5	0–2	1.1
Northern Ireland	2	462	1.0	0–4	1.5
United Kingdom	2	2595	0.3	1–3	1.2
Demarcated opacity and hypoplasia					
England	*	1356	*	*	1.1
Wales	*	559	*	*	1.3
Northern Ireland	1	462	0.4	0–2	1.1
United Kingdom	*	2595	*	*	1.3
Diffuse opacity and hypoplasia					
England	1	1356	0.2	1–1	1.2
Wales	*	559	*	*	1.0
Northern Ireland	1	462	0.4	0–2	1.1
United Kingdom	1	2595	0.2	1–1	1.4
Any of the above defects					
England	35	1356	2.2	31–39	1.7
Wales	29	559	2.5	24–34	1.3
Northern Ireland	33	462	3.0	27–39	1.4
United Kingdom	34	2595	2.0	30–38	2.0

Non-carious dental conditions**Table A4** Standard errors and 95% confidence intervals for proportion of children with accidental damage to the incisors (United Kingdom, 2003)

	Percentage (p)	Unweighte d sample size	Standard error of p	95% confidence intervals	Deft
England					
Boys					
8 year olds	6	792	1.0	4–8	1.2
12 year olds	14	693	1.2	12–16	1.0
15 year olds	16	554	1.8	12–20	1.1
Girls					
8 year olds	4	755	0.8	2–6	1.1
12 year olds	7	663	1.3	4–10	1.3
15 year olds	10	562	1.3	7–13	1.1
All children					
8 year olds	5	1547	0.6	4–6	1.0
12 year olds	11	1356	0.7	10–12	1.0
15 year olds	13	1116	1.2	11–15	1.2
Wales					
Boys					
8 year olds	5	305	1.2	3–7	0.9
12 year olds	11	287	3.2	5–17	1.7
15 year olds	14	269	1.9	10–18	1.0
Girls					
8 year olds	1	268	0.4	0–2	1.0
12 year olds	7	272	1.3	4–10	1.0
15 year olds	12	196	3.2	6–18	1.4
All children					
8 year olds	3	573	0.5	2–4	1.0
12 year olds	9	559	1.5	6–12	1.2
15 year olds	13	482	2.0	9–17	1.3
Northern Ireland					
Boys					
8 year olds	5	244	1.6	2–8	1.1
12 year olds	19	281	3.5	12–26	1.5
15 year olds	23	196	3.8	16–30	1.2
Girls					
8 year olds	5	227	1.9	1–9	1.3
12 year olds	10	181	2.2	6–14	1.0
15 year olds	11	184	3.2	5–17	1.4
All children					
8 year olds	5	472	1.1	3–7	1.1
12 year olds	16	462	2.8	11–21	1.6
15 year olds	17	380	2.8	12–22	1.5

Non-carious dental conditions**Table A4 (continued) Standard errors and 95% confidence intervals for proportion of children with accidental damage to the incisors (United Kingdom, 2003)**

	Percentage (p)	Unweighte d sample size	Standard error of p	95% confidence intervals	Deft
United Kingdom					
Boys					
8 year olds	6	1447	0.9	4–8	1.4
12 year olds	14	1379	1.1	12–16	1.2
15 year olds	16	1097	1.5	13–19	1.4
Girls					
8 year olds	4	1342	0.7	3–5	1.2
12 year olds	8	1216	1.2	6–10	1.5
15 year olds	10	1045	1.2	8–12	1.3
All children					
8 year olds	5	2790	0.5	4–6	1.2
12 year olds	11	2595	0.6	10–12	1
15 year olds	13	2142	1.0	11–15	1.4