



Technical Report

2003 Children's Dental Health Survey

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Table of contents

Introduction	1
Overview of survey design.....	1
Coverage of the survey.....	2
Ethical clearance	2
Coverage of the technical report.....	2
Related publications.....	3
Sampling procedure	4
Sample Design	4
Sampling frames	4
Sampling procedures in England, Scotland and Wales	5
Sampling in Northern Ireland	6
The examinations.....	8
The Examination Criteria.....	8
Recruitment and training of dental examiners and recorders.....	8
The calibration exercise	10
Fieldwork arrangements.....	11
Response to the examinations	13
The Questionnaire.....	15
Questionnaire development.....	15
Sending out the questionnaires.....	15
Response to the questionnaire.....	16
Data Processing.....	17
Data Coding and Cleaning.....	17
Derived variables	17
Weighting the data.....	17
Appendix A The conduct of the examination and criteria for the assessments.....	24
Appendix B The Dental Team.....	39
Appendix C Glossary of terms	41

List of Tables

Table 1 Kappa statistics from calibration exercise	10
Table 2 Calibration exercise for caries (means, standard deviations and coefficients of variation)	11
Table 3 Response from primary and secondary schools (United Kingdom, 2003)	13
Table 4 Response from primary and secondary schoolchildren (United Kingdom, 2003).....	14
Table 5 Questionnaire Response	16
Table 6 Unweighted sample size and weighted bases: children examined (United Kingdom, 2003)	18
Table 7 Population weighting factors for survey sample	23

Introduction

The 2003 Children's Dental Health Survey is the fourth in a series of national surveys of children's dental health, carried out every 10 years since 1973. The purpose of the survey series is to establish the state of the dental health of children in the United Kingdom, and to monitor change since earlier surveys.

The 1973 survey established baseline information on the state of the dental health of children in England and Wales. It was repeated in 1983 and 1993 and was extended in both years to include Scotland and Northern Ireland. The 2003 survey also covered the four constituent countries of the United Kingdom. Its purpose was to establish the current state of the dental health of children in the United Kingdom and monitor change since the earlier surveys. It was jointly commissioned by the Department of Health, the Welsh Assembly Health Department, the Scottish Executive Health Department and the Department of Health and Personal Social Services in Northern Ireland.

Overview of survey design

The survey was piloted in November 2002, the main training and calibration exercise took place in October 2003, and fieldwork took place between October 2003 and March 2004. As in the three earlier surveys, dental examiners were recruited to carry out examinations on the sampled children in participating schools.

Schools were sampled by obtaining lists of maintained and independent schools from the relevant education departments. Sampled schools were asked to participate in the survey and those that agreed forwarded lists of children in the eligible age groups at their school to ONS. These lists were used to randomly select an appropriate quota of children for each school. Full details of the sampling procedure are provided in this report.

Dental examinations were carried out in schools between October and December 2003. The criteria for the examinations were developed jointly by teams from the Dental Schools of the Universities of Birmingham, Cardiff, Dundee, and Newcastle and the Dental Health Services Research Unit, Dundee (Appendix A). The criteria were agreed by a steering committee made up of representatives from the commissioning health departments, the university dental schools and the Community Dental Services.

Background data were collected from the parents of a random sub-sample of examined children in each age group by questionnaire. Questionnaires were distributed between December 2003 and March 2004. The questionnaire retained the majority of questions and topics from the 1993 survey to allow changes in behaviour and attitudes to be measured, although some questions were developed further and some new topics added.

Coverage of the survey

The surveyed population included children aged 5, 8, 12 and 15 years of age attending state and independent primary and secondary schools throughout the United Kingdom.

Although the previous Children's Dental Health Surveys examined children aged between 5 and 15 years, the 1993 survey indicated there was little change in the exfoliation of primary dentition or eruption of permanent dentition over time (O'Brien, 1994, pp 15–16). Since little new information would be gained from collecting clinical data for all age cohorts, the 2003 survey concentrated on children aged 5, 8, 12 and 15 years. These age groups correspond to those associated with oral health targets for children set by the UK Departments of Health. The 2003 survey also, for the first time, examined children at independent schools to provide estimates of all children rather than just those attending state schools.

Ethical clearance

Ethical approval was obtained before any examiner training or fieldwork was undertaken. The London Multi-Centre Research Ethics Committee (MREC) was given full details of both the pilot survey and main survey and training. Ethical clearance for the pilot survey and training was granted in October 2002 and clearance for the main survey and training was given in April 2003.

Local Regional Ethics Committees (LRECs) in areas covered by the survey and training were subsequently provided with a copy of the MREC approval as well as details of the dental examiners working in their region.

As in previous surveys, permission to approach local authority schools was sought from Local Education Authorities before any schools were contacted.

Coverage of the technical report

This technical report provides information to assist in interpreting the findings of the 2003 Children's Dental Health Survey. Topics covered are:

- The sampling procedures
- The examination criteria and their development
- Details of examiner training, fieldwork procedures and the response obtained
- The questionnaire and its development
- Details of questionnaire distribution and the response obtained
- Details of the data processing carried out

Related publications

This technical report relates to a series of publications arising from the 2003 Children's Dental Health Survey. These include:

- Dental decay experience (October 2004)
- Non carious dental conditions (October 2004)

- Periodontal condition, hygiene behaviour and attitudes to oral health (October 2004)
- Patterns of care and service use (December 2004)
- Impact of oral health on children (December 2004)
- Orthodontic treatment need and provision (December 2004)
- Social and behavioural characteristics associated with dental health (December 2004)
- Summary Report (March 2005)
- Children's Dental Health in England 2003 (March 2005)
- Children's Dental Health in Northern Ireland 2003 (March 2005)
- Children's Dental Health in Wales 2003 (March 2005)

Sampling procedure

The sample design and sampling procedures were based on those used in the previous rounds of the survey, with minor refinements and enhancements.

Sample Design

The size of the 2003 sample needed to allow for separate analysis for each sampled year cohort within England, Northern Ireland and Wales and across the UK as a whole. Separate analysis for Scotland was not required by the Scottish Executive Health Department. The sample also needed to be geographically clustered so that travelling time for the dental examiners was minimised and their workload (e.g. the sample size and the number of schools to be visited) was manageable.

The sample was divided equally between children aged 5, 8, 12 and 15 on 31 August 2003. The 31 August cut off ensured that the children were of a comparable age to those involved in the previous rounds of the survey in 1973, 1983 and 1993. Questionnaires were sent to half of the parents of examined children.

Concentrating the sample in these four age groups provided an increased sample in each age cohort, compared to the previous rounds of this survey, and allowed for regional analysis and analyses looking at deprivation.

Children from schools with more than 30% of children eligible for free school meals were defined as deprived and were oversampled relative to those with lower proportions of free school meal eligibility, so that they would make up approximately a third of the overall sample. The proportion of children eligible for free school meals is a school-level indicator that has been shown to be very highly correlated with the socio-economic status of the children and their parents.

Children in Wales and Northern Ireland were also oversampled relative to England, to allow for the comparative analysis of the dental health of children in England, Wales and Northern Ireland. There was no oversampling in Scotland relative to England as separate analysis for Scotland was not required. The sample in England and Wales is also large enough to produce regional estimates in these countries. Regional estimates are not applicable to Northern Ireland, as the country is not divided into regions.

Sampling frames

Schools

A list of maintained and independent schools, showing the number of children in each age group at the school and the proportion of children at the school that are eligible for free school meals, was obtained from the relevant Education Departments.

The relevant Education Authorities were written to for permission to approach the maintained schools about taking part in the survey. No schools were excluded from the sample at this stage.

Children

Schools that agreed to take part in the survey were asked to send ONS a list of children at their school who were aged 5, 8, 12 and 15 on the 31st August 2003.

Exclusions

Special schools were excluded.

For Scotland, schools located on islands (Isle of Skye, Shetland, Orkney, and Eilean Siar) were excluded.

Sampling procedures in England, Scotland and Wales

Sampling Regions

Seventy-two Local Authority Districts (LADs) in England, 24 Unitary Authorities (UAs) in Wales and eight Education Authorities (EAs) in Scotland were selected with probability proportional to size (i.e. the number of pupils in the eligible age cohorts). Birmingham LAD in England was a special case where two main secondary schools were sampled.

Schools with more than 30% of children eligible for free school meals were weighted up so that areas with more 'deprived' schools were oversampled.

In England, Government Office Region (GOR) and in Wales, Region were used as explicit stratifiers. Eight LADs were selected from each GOR and 8 UAs were selected from each of the three regions in Wales.

There were no regional exclusions, but Isles of Scilly was included with Cornwall. In addition, City of London schools were included with Islington. Schools in Scottish Islands were also excluded.

Sampling Schools

All primary schools in the sampled regions were grouped with the secondary schools so that each group contained children of both sexes from each of the four age cohorts. As much as possible, schools were grouped so that the ratio of primary to secondary school pupils in the district was maintained within each school group. Schools with similar free school meal eligibility rates were also, where possible, grouped together.

Once the grouping had taken place, one school group was selected from each area with probability proportional to size. Schools with more than 30% of children eligible for free school meals were weighted [up] so that school groups with more 'deprived' schools would be oversampled.

A replacement school group for each area was then selected as secondary schools were to be sampled with replacement. This was because in the 1993 survey response at the secondary school level had been lower than the response at primary schools. In order to select a replacement group the secondary schools were ordered by area, deprivation status (i.e. whether the school had more than 30% of children eligible for free school meals) and size. This ensured that the replacement secondary school was a close match to the initially sampled secondary school. The replacement secondary school was the school next in the frame after the secondary school sampled. If the secondary school sampled was the last in the deprived stratum, the secondary school preceding it was selected as the replacement. If there was only one secondary school in that stratum, then the first secondary school in that LAD was selected. Once the replacement secondary school had been identified, the schools that had been grouped with it were identified and formed the replacement school group.

Secondary schools were approached first about participating in the survey. If the secondary school in the initially selected group refused the secondary school in the replacement school group was approached. Once the secondary school had agreed, the primary schools in the group were approached. This ensured that the sampled schools remained geographically clustered.

Some school groups had more than 10 schools in them, which would have been difficult for the dental examiner to visit within the fieldwork period. Additionally, some of the schools within a group contained only a small number of pupils, which would have been disproportionately expensive to visit. For these reasons, the number of schools within a group was curbed to 10 or less. Small schools were randomly eliminated from the large school groups. If there were still more than 10 schools in the group the remaining schools were sampled using equal probability.

Sampling children

Participating schools were asked to send ONS a list of the children at their school in the eligible age cohorts. The list for each school was ordered by sex and date of birth. Thirty seven children from each age cohort were sampled from each school group. A fixed sampling interval for each school and a random start number was calculated and used to draw the sample of children.

The sampled children were allocated a unique serial number. Parents/carers of children that were examined by the survey dentist and had an odd serial number were selected to receive a questionnaire.

Sampling in Northern Ireland

Sampling schools

Due to the smaller spread of schools in Northern Ireland geographical clustering was not required and a simple random sample of schools in Northern Ireland was

taken. This was manageable for the dental teams and is a more efficient sample design than the one required for England, Wales and Scotland. Children at schools with more than 30% of children eligible for free school meals were oversampled and all schools were sampled with replacement.

Schools which did not have the required number of pupils in the relevant age groups were grouped with the nearest school with the same 'deprived' status (i.e. both had more than 30% of children eligible for free school meals or both had 30% or fewer).

The only explicit strata used were the division of whether a school was primary or secondary.

For every school sampled a replacement school was also required for both primary and secondary schools. The list of schools was ordered by deprivation status, area, size and school type (i.e. state or private school). The replacement school was the school next in the frame after the actual school selected to participate. If it was the last school on the list then the school preceding it was selected.

Finally, schools with less than 3 pupils sampled were excluded from the sample due to the disproportionately large cost of going to these schools to sample 1 or 2 children.

Sampling children

Participating schools were asked to send ONS a list of the children at their school in the eligible age cohort. The list for each school was ordered by sex and date of birth. Nine 5 year olds and nine 8 year olds were sampled from each Primary school or group of Primary schools and twenty seven 12 year olds and twenty seven 15 year olds were sampled from each Secondary school or group of Secondary schools. A fixed sampling interval for each school and a random start was used.

The sampled children were allocated a unique serial number. Parent's of children that were examined by the survey dentist and had an odd serial number were selected to receive a questionnaire.

The examinations

Dental examinations in the sampled schools were carried out between October and December 2003. Dental examiners carried out the examinations and a recorder noted the results. Recorders were the dental nurses who usually worked with the dental examiners. All examinations followed a set procedure and used the same criteria for all children within each age group, although the clinical parameters measured varied between age groups.

The Examination Criteria

The 2003 examination criteria retained many of the measures used in earlier surveys, with minor refinements in some areas.

The criteria used to assess the condition of individual teeth and tooth surfaces were revised to include visual as well as cavitated dentine criteria.

The two indices introduced in the 1993 survey to measure tooth surface loss and enamel opacities were retained. Both indices comprise of two components to assess the severity of any defect and the proportion of the surface affected. The tooth surface loss index for the primary and permanent maxillary incisors was extended to include the first permanent molars.

A simplified version of the Dental Health Component of the Index of Orthodontic Treatment Need (IOTN) was used in line with screening surveys such as those undertaken by the British Association for the Study of Community Dentistry (BASCD). The simplified version only records definite treatment needs and incorporates borderline need into no need categories.

The assessment of periodontal pocketing among 15-year-olds was removed from the 2003 criteria. This was the most invasive part of the examination, involving the insertion of a periodontal probe into the pocket. Since the accepted prevalence of early on-set or very aggressive forms of periodontal disease is in the order of 0.1%, this would not be picked up using the sample size of this survey. Therefore, a decision was taken to restrict the periodontal assessment for 15-year-olds to presence of gingivitis.

Trauma to the permanent incisors was assessed as in previous surveys.

Full details of the criteria used in the examination can be found in Appendix A.

All criteria were piloted in the Spring of 2003. Children aged 5,8,12 and 15 from West Midlands schools acted as subjects for the pilot testing which took place within schools. The pilot study did not indicate the need to revise any of the criteria.

Recruitment and training of dental examiners and recorders

Dental examiners and recorders were recruited from dentists working in the community dental service across the UK, following advice from Regional Dental Contacts and existing Regional NHS dental survey co-ordinators. Potential

volunteers were contacted and following their provisional agreement, permission to include volunteers was obtained from their respective Clinical Director or line manager.

In preparation for the training period, copies of the diagnostic criteria, data collection documents and a specially developed training CD-Rom were sent to examiners. Examiners were instructed to review this information and practice using the CD-Rom. All examiners were expected to have a working knowledge of the criteria and charting procedures when they arrived for training.

Sixty-six dental teams, consisting of an examiner and recorder, were trained over two three-day training periods.¹ Children aged 5 to 15 years from schools in the West Midlands and undergraduate dental students from the University of Birmingham acted as subjects for the examiner training, which took place in a local town hall. The children involved in the training exercise were screened by staff from the University of Birmingham Dental School to produce a range of dental conditions suitable for training and calibration.

The training programme for both training periods was identical. On the afternoon prior to the training, dental examiners attended an initial briefing to introduce the survey, set out the training programme and clarify understanding of diagnostic criteria. On the first day the examiners worked in pairs rotating duties between examining and recording with 5- to 15-year-old children. Practice in the use of periodontal probes for the assessment of gingivitis was carried out on the dental students. This procedure was to be applied only to 15-year-olds in the fieldwork stage. The recorders arrived during the afternoon of the first day and a briefing was held with this group to introduce the survey and discuss data recording procedures. The examiners and recorders met on the second evening for a joint session to practice charting and cover aspects arising from the training to date. For the second day of training examiners worked with their recorders examining further groups of 5- to 15- year- old children and also took part in a seminar covering the administrative procedures of the survey. A briefing session was held at the end of the day to discuss any emerging issues.

Full cross-infection precautions were taken at all times during the training examinations. Staff from the Consortium of Universities were present during all examinations to assist with any difficulties. Occasionally all the examiners would be called together to discuss problems which arose and provide feedback on interpretation of the agreed criteria. A calibration exercise took place on the final day of the training programme.

¹ A separate training session and calibration exercise was held for three dental teams in Northern Ireland who were unable to attend the West Midlands training event. These teams were calibrated against an examiner who had attended the West Midlands training.

The calibration exercise

The calibration exercise involved groups of dental examiners, with their recorders, examining groups of 10 children in a similar situation to that in which they would carry out the main fieldwork. At the time of the calibration exercise, data were collated manually to identify potentially high scoring examiners. Subsequently, the results were analysed to assess statistically the degree of agreement between dental examiners. As agreed with the commissioners, the calibration exercise only covered caries given that the likely prevalence of other tooth conditions was too low for meaningful analysis to occur.

Cohen's Kappa statistics were calculated to indicate the extent to which examiners agreed in the identification of decayed and filled teeth. The prevalence of missing teeth among the training subjects was minimal and prevented meaningful Kappa values being calculated.

Cohen's Kappa is a measure of agreement that can be calculated between any pair of examiners and takes chance agreement into account. Kappa values were produced for each possible pairing of examiners within each group, with overall mean Kappa statistics derived from the individual pairings. Table 1 displays the mean Kappa values for each group of examiners in coding teeth as decayed or filled.

Table 1 Kappa statistics from calibration exercise

Examiner Group	Decayed teeth	Filled teeth
A	0.8	0.86
B	0.85	0.79
C	0.8	0.87
D	0.77	0.88
E	0.65	0.76
F	0.7	0.86
G	0.8	0.91
H	0.79	0.75

Kappa values greater than 0.81 indicate excellent agreement and between 0.61 and 0.80 substantial agreement (Landis and Koch, 1977²). Table 1 shows that group means for examiners indicated substantial agreement in all groups and excellent agreement in six instances.

Variation between examiners was also assessed through calculating means and standard deviations for actively decayed teeth (DT), filled teeth (FT), and decayed, missing or filled teeth (DMFT) and examining the associated coefficients of variation. Table 2 displays the variation between dental examiners in each

² Landis J R and Koch G G (1977) The measurement of observer agreement for categorical data. *Biometrics* 33, 159–174.

group. The less variation there is between dental examiners, indicated by a small coefficient of variation, the more consistent their measurements can be said to be.

Table 2 Calibration exercise for caries (means, standard deviations and coefficients of variation)

	Group of dentists							
	A	B	C	D	E	F	G	H
Number of dentists	8	7	8	9	8	8	9	9
Number of children	10	10	10	10	10	10	10	10
Decay into dentine (D_{3cv})								
Mean	1.67	1.46	2.10	2.09	2.00	1.20	1.90	2.09
Standard deviation	0.22	0.19	0.27	0.27	0.61	0.25	0.30	0.39
Coefficient of variation	0.14	0.13	0.13	0.13	0.30	0.20	0.16	0.19
Filled (otherwise sound)								
Mean	0.11	0.32	0.67	0.50	0.74	1.31	0.48	0.34
Standard deviation	0.06	0.08	0.12	0.05	0.07	0.16	0.07	0.13
Coefficient of variation	0.50	0.25	0.18	0.10	0.10	0.12	0.15	0.37
Obvious decay experience ($D_{3cv}MFT$)								
Mean	1.78	1.79	3.16	2.60	2.86	2.50	2.37	2.44
Standard deviation	0.27	0.19	0.25	0.28	0.56	0.29	0.28	0.37
Coefficient of variation	0.15	0.10	0.08	0.11	0.19	0.12	0.12	0.15

Measurements of the number of decayed, missing or filled teeth show little variability. The value of the coefficient of variation is, at its highest, 0.19 (group E). The number of decayed teeth shows a higher degree of variation, with a maximum value for the coefficient of variation of 0.30 (group E). The measurement of filled teeth showed the highest degree of variability, with the two of the coefficients exceeding 0.30 (group A and group H).

Fieldwork arrangements

Those schools who agreed to participate in the survey were contacted by telephone to arrange a suitable date for the dental examinations. Dates were confirmed in writing with both schools and dental examiners. A list of the sampled students within each school was then forwarded to schools and dental examiners alike.

Data protection procedures prevented schools from providing the survey team with address details for the sampled children. Therefore, advance letters and information leaflets for parents/carers were forwarded to schools; in stamped envelopes to be addressed and posted to home addresses. The advance letter listed a free-phone telephone number and a contact at ONS where more information about the survey could be obtained and where withdrawal from the survey could be registered. Parents/carers were also told that they could inform the school if they did not want their child to take part. The letters specified that if

neither ONS nor the school was informed of a withdrawal, dental examiners would ask to examine a child during the allocated school visit. Separate information leaflets and letters were provided for 12- and 15-year-old children. These outlined the aims of the survey and the consequences of participation, as well as providing information on withdrawal procedures.

In England, Northern Ireland and Wales, information about the survey stated that individual feedback from the examinations would not be provided. This was intended to minimise the possibility that the survey was perceived as a substitute for regular dental checks. However, in Scotland there was a legal requirement to disclose the outcome of the examination. The parents/carers of children examined in Scotland were provided with feedback from the examination in accordance with the National Dental Inspection Programme and current interpretation of the Education (Scotland) Act 1980 and its most recent amendments. Dental examiners recorded the outcome of the examination on a standard feedback form, which was placed in a sealed envelope labelled with the child's name and left with school staff to post out to the children's parents/carers.

Welsh language versions of all advance information were provided for parents and children in Wales. The advance letters and leaflets were also translated into a further nine languages (Arabic, Albanian, Bengali, Cantonese, Gujarati, Hindi, Punjabi, Somali and Urdu). Postage paid reply cards were sent with the initial letter so that translated versions could be requested. Information about the survey was also put on to the National Statistics and Northern Ireland Statistics and Research Agency (NISRA) web-sites.

ONS maintained a record of withdrawals throughout the fieldwork period and dental examiners were instructed to contact ONS on the morning of each school visit to check for withdrawals. Examiners were also told to enquire whether any additional withdrawals had been made directly to the school. Children were free to withdraw from the examination on the date of the school visit.

Schools made different arrangements for the children to be examined. In most primary schools children came to be examined in groups, with a small number of children waiting while one child was being examined. Most secondary schools preferred to give children an appointment time so they could arrive individually for their examination.

Within each school, the dental examinations took place in a private room or space. Schools were asked to provide a room or area with a window, since part of the examination was ideally to be carried out in natural light. Illumination was required for some of the examination and dental examiners brought Daray lamps to the schools for this purpose. Schools were also asked to ensure that a table was provided, so that children could be examined in a reclining position. Examination times were approximately five minutes for primary school children (5- and 8-year-olds) and eight to ten minutes for secondary school children (12- and 15-year-olds).

In Scotland, dental examiners completed the standard feedback form at the end of each examination. Forms were placed in a sealed envelope, labelled with the child's name, and left at the school for distribution to parents/carers.

Response to the examinations

The survey relied on the cooperation of schools and the students within them. First, the consent of individual schools to involve their students was required. The school level response was 71% for the United Kingdom (Table 3). This was lower than 1993 response when only 5% of schools refused.

Table 3 Response from primary and secondary schools (United Kingdom, 2003)

	England	Wales	Scotland	Northern Ireland	United Kingdom
Secondary schools selected	130	35	11	26	202
Secondary schools agreeing	77	26	8	21	132
Primary schools selected	446	185	55	88	774
Primary schools agreeing	305	140	40	72	557
Total schools selected	382	220	66	114	976
Total schools agreeing	194	166	55	93	689
Response rate					
Secondary	59%	74%	73%	81%	65%
Primary	68%	76%	73%	82%	72%
All schools	66%	75%	73%	82%	71%

In total, 10,381 children were examined, 82% of those sampled. Table 4 shows the number of children sampled and children's response to examinations. As with schools, the children's response was less good than in 1993 when 90% of children were successfully examined.

Seven per cent of children were absent when the dentist visited the school, some on more than one occasion, 3% were withdrawn by their parents and 2% had left school between the sample being drawn and the fieldwork. These proportions were similar to the 1993 survey. However, in 1993 there were no recorded instances of children withdrawing from the survey while in 2003 4% of children refused to participate.

Technical Report

Table 4 Response from primary and secondary schoolchildren (United Kingdom, 2003)

	England	Wales	Scotland	Northern Ireland	United Kingdom
Number of children sampled:					
5-year-olds	1,843	676	225	521	3,265
8-year-olds	1,731	651	220	528	3,130
12-year-olds	1,712	655	256	506	3,129
15-year-olds	1,723	660	258	533	3,174
All children	7,009	2,642	959	2,088	12,698
Number of children examined:					
5-year-olds	1,620	582	196	456	2,854
8-year-olds	1,547	573	198	472	2,790
12-year-olds	1,356	559	218	462	2,595
15-year-olds	1,116	482	164	380	2,142
All children	5,639	2,196	776	1770	10,381
Reasons for non-examination: all children					
	%	%	%	%	%
Child absent all visits	6	8	8	7	7
Child refused	6	3	6	2	4
Parent refused	3	3	3	2	3
Child left school	2	2	3	*	2
Other	2	1	*	4	2
Successfully examined:					
5-year-olds	88	86	87	88	87
8-year-olds	89	88	90	89	89
12-year-olds	79	85	85	91	83
15-year-olds	65	73	64	71	68
All children	80	83	81	85	82

The Questionnaire

Background data on children's oral hygiene and dental care and were requested by questionnaire from the parents of a random sub-sample of half the examined children.

Questionnaire development

The 1993 questionnaire formed the basis of the 2003 questionnaire so that results could be compared to previous rounds of the survey.

New areas to the questionnaire for 2003 include:

- Barriers to dental care – including access to NHS services, taking children to the dentist and taking time off work, anxiety about going to the dentist
- Marks on teeth
- Oral quality of life – a measure of the subjective impact of oral health
- Referral to an orthodontist

The questionnaire was tested by the Qualitative Methods Applied to Surveys (QMAS) Unit at ONS, who are experienced in questionnaire design and testing. The testing involved an expert review of the questionnaire and questionnaire design by a survey methodologist and cognitive testing. Cognitive testing explores the mental process by which respondents reach an answer to a question and aids the development of a questionnaire by suggesting unambiguous question-wording, layout and routing that respondents understand in the way the researcher intends.

The completed questionnaires from the pilot survey were also examined and minor amendments to the routing and order of the questions made where respondents had had difficulty, for example following the wrong route through the questionnaire.

Sending out the questionnaires

Schools were unable to release the home addresses of the sampled children to ONS due to the Data Protection Act. Questionnaires were therefore sent to the participating schools in stamped envelopes for the school to address and post to the parents/carers of the selected examined children. Two reminder questionnaires were sent to non-responders, again via the school. A slip was included with the reminder questionnaires offering parents/carers the option to have a telephone interview instead of completing the questionnaire or to phone for assistance with completing their questionnaire. One telephone interview was carried out on request.

Response to the questionnaire

In total, 3,342 questionnaires were returned by the parents/carers of examined children, 61% of those receiving a questionnaire. Response is lower than in 1993 when 84% of parents returned a questionnaire. In 2003, for reasons of data protection, schools were unwilling to provide ONS with home addresses of the selected children. Therefore schools were asked to forward questionnaires and reminders to the parents.

Table 5 Questionnaire Response

	England	Wales	Scotland	Northern Ireland	United Kingdom
	%	%	%	%	%
Replied	65	62	68	45	61
Refused	34	36	30	55	37
Other non response (e.g. questionnaire returned by Royal Mail)	2	2	1	-	1
Base = 100% (all parents who received a questionnaire)	2962	1158	414	946	5480

Percentages may not add to 100 due to rounding.

Data Processing

Data Coding and Cleaning

Examination data was entered into an SPSS file and a series of data cleaning processes carried out. These included frequency checks to establish that teeth were consistently recorded as present deciduous or permanent teeth across all sections of the questionnaire. Any anomalies were addressed with reference to the original examination form. Where discrepancies could not be resolved easily, advice was sought from the consortium of dental academics. For each variable system missing values were recoded to 'not applicable' or 'missing' depending upon the reason the data was not available.

Questionnaire data was imported into the Blaise software package, a Computer Assisted Personal Interview (CAPI) software package. The Blaise program contained routing so that checks could be made that any questions relevant to the respondent had been completed. The program was also used to check if data was within an allowed range or was an unlikely response. Discrepancies were resolved by reference to the written questionnaire. Responses to questions on occupational status were coded within Blaise according to the National Statistics Socio-economic status (NS-SEC) coding frame. Additional coding of certain text response was also carried out within Blaise. Once the questionnaire data had been coded and cleaned within Blaise, an SPSS data file was produced.

Derived variables

For many of the concept in the report, it was necessary to create new variables to represent them. For example, obvious decay experience could not be determined by a single variable and needed to be calculated from examiners' assessment of the condition of all teeth present in a child's mouth.

Weighting the data

While the sample selected within each country gave equal probability to each child of selection within that country, Wales and Northern Ireland were oversampled relative to England within the United Kingdom. Response within each age group also differed between the countries. In order that the sample estimates should be representative of the United Kingdom, the data were therefore weighted back to population proportions within age groups. Table 6 displays the unweighted sample size and weighted bases for examined children.

Table 6 Unweighted sample size and weighted bases: children examined (United Kingdom, 2003)

	England	Wales	Scotland	Northern Ireland	United Kingdom
Unweighted sample size					
5-year-olds	1,620	582	196	456	2,854
8-year-olds	1,547	573	198	472	2,790
12-year-olds	1,356	559	218	462	2,595
15-year-olds	1,116	482	164	380	2,142
All children	5,639	2,196	776	1770	10,381
Weighted bases					
5-year-olds	2,136	123	199	80	2,538
8-year-olds	2,183	126	209	81	2,599
12-year-olds	2,249	133	218	89	2,689
15-year-olds	2,142	128	195	91	2,556
All children	8,710	510	821	341	10,382

The weights to adjust for unequal probabilities were computed as the reciprocals of the probabilities of selection for the sample. For England, Wales and Scotland the sampling probabilities should be:

$$P(\text{pupil}) = P(\text{LAD}) \times P(\text{SG}|\text{LAD}) \times P(\text{Pup}|\text{SG})$$

where

$P\{\text{LAD}\}$ = Probability that the LAD is sampled from GOR

$P\{\text{SG}|\text{LAD}\}$ = probability that the school group is sampled from the LAD

$P\{\text{Pup}|\text{SG}\}$ = probability that a pupil in an age group is sampled from a school group

$$P(\text{LAD}) = \frac{MOS_{LAD}}{MOS_{GOR}} \times n_{lad}$$

$$P(\text{SG}|\text{LAD}) = \frac{MOS_{SG}}{MOS_{LAD}} \times n_{sg}$$

where,

MOS_{LAD} = measure of size within LAD

MOS_{GOR} = measure of size within GOR

n_{lad} = number of LADs sampled from GOR = 8

n_{sg} = number of school groups sampled from LAD = 1

MOS_{SG} = measure of size within School Group

Small schools (those expected to sample fewer than 3 pupils) within groups were excluded ('skimmed'). If there were still more than 10 schools in a school group, schools (other than the main secondary school) were subsampled with equal probability to reduce the number of schools in the group to 10. Once the schools were 'skimmed' and subsampled the number of pupils to be sampled from the remaining schools was re-calculated as a proportion of the MOS of these schools. i.e.

$$n_{pup_{set(age)}} = \frac{MOS_{sch(age)}}{MOS_{SG(age)}^s} \times 37$$

where

$n_{pup_{set(age)}}$ = number of pupils to be sampled in each year school group = 37

$MOS_{sch(age)}$ = MOS of the school in each year group

$MOS_{SG(age)}^s$ = MOS of the school group after skimming and subsampling

To adjust for this a scaling factor is applied to account for the exclusion of small schools equal to

$$skimfactor = \frac{MOS_{SG(age)}^{sk}}{MOS_{SG(age)}}^s$$

where

$MOS_{SG(age)}^{sk}$ = MOS of school group with small schools removed

The probability that a school is sampled from a school group is

$$p(\text{sample school from school group}) = \frac{(n_schsamp - 1)}{(n_sch - 1)}$$

or

$$p(\text{sample school from school group}) = 1$$

for the main secondary school.

Where

$n_schsamp$ = number of schools subsampled in school group

n_sch = number of schools originally in school group

NB. 1 is subtracted from numerator and denominator because the main secondary school is never subsampled.

The probability of pupil selection is

$$P(\text{Pup}|\text{SG}) = \frac{n_pup_{set(age)}}{N_{SCACT(age)}}$$

where

$n_pup_{set(age)}$ = set pupil numbers by age group for each school

$N_{SCACT(age)}$ = actual pupil numbers found in each age group in each school

The overall probability of selection is therefore

$$\begin{aligned}
 P(\text{select any pupil in age group}) &= \left(\frac{MOS_{LAD} * n_{lad}}{MOS_{GOR}} \right) \times \left(\frac{MOS_{SG} * n_{sg}}{MOS_{LAD}} \right) \times \left(\frac{MOS_{SG}^{sk}}{MOS_{SG(age)}} \right) \\
 &\quad \times \left(\frac{(n_{schsamp} - 1)}{(n_{sch} - 1)} \right) \times \left(\frac{n_{pup_{set(age)}}}{N_{SCACT(age)}} \right) \\
 &= \frac{8 * MOS_{SG}}{MOS_{GOR}} \times \frac{MOS_{SG}^{sk}}{MOS_{SG(age)}} \times \frac{(n_{schsamp} - 1)}{(n_{sch} - 1)} \times \frac{n_{pup_{set(age)}}}{N_{SCACT(age)}}
 \end{aligned}$$

Therefore the weight is calculated as

$$\text{weight} = \frac{1}{P(\text{select any pupil in age group})} = \frac{MOS_{GOR}}{8 * MOS_{SG}} \times \frac{MOS_{SG(age)}}{MOS_{SG}^{sk}} \times \frac{(n_{sch} - 1)}{(n_{schsamp} - 1)} \times \frac{N_{SCACT(age)}}{n_{pup_{set(age)}}}$$

Scotland

There was a slightly different sample design in Scotland as schools were stratified implicitly by region rather than explicitly and 8 LADs (UAs) sampled from Scotland as a whole so MOS_{GOR} in the equation above is replaced by

MOS_{SCO} (the MOS for Scotland as a whole).

Northern Ireland

Northern Ireland adopted a slightly different design. Primary schools were sampled separately from secondary schools as the distinction between the two was far clearer (i.e. very few independents and middle schools). Therefore primary schools were not grouped with secondary schools all though there was some grouping of smaller schools with larger schools and some of these small schools were excluded on cost grounds. Therefore some 'skimming' was involved.

There was no sampling of LEAs stage – schools were sampled from a complete list of all Northern Ireland schools (sorted by free school meal indicator, type, area and MOS). The only explicit strata were primary/secondary school.

Seventy-two primaries (or primary groups) were sampled (and 72 replacements). Eighteen pupils were required from each of these - nine per age group. Twenty-four secondary schools were sampled (and 24 replacements) and 54 pupils were sampled from each of these - 27 from each age group.

Sampling probabilities were as follows:

$$P(\text{select pupil from primary school}) = \frac{MOS_{SG}}{MOS_{NI}} \times n_{sg} \times \frac{MOS_{SG(age)}^{sk}}{MOS_{SG(age)}} \times \frac{n_{pup_{set(age)}}}{N_{SCACT(age)}}$$

As no skimming was necessary for secondary schools the probability of selecting secondary school children was:

$$P(\text{select pupil from secondary school}) = \frac{MOS_{SG}}{MOS_{NI}} \times n_{sg} \times \frac{n_{pup_{set(age)}}}{N_{SCACT(age)}}$$

where

MOS_{NI} = MOS for Northern Ireland

and n_{sg} for primary school is 72 and for secondary school is 24.

and the weight is calculated as

$$\text{weight} = \frac{1}{P(\text{select any pupil in age group})}$$

Nonresponse Weighting

It was evident that there was some variation in response rates across countries, age groups and deprived/non-deprived groups, although real response rates were difficult to calculate due to the substitution of non-responding schools in the first wave and the differing size of sampled schools. For this reason a nonresponse weight equal to the reciprocal of the response rates was not used as this would have delayed analysis. As an alternative the sampled weighted by the probability weights was weighted up to known population totals. The population was that of August 2003 and since population totals for 2002 were used in the original sampling, this should also adjust for relative over and under-coverage in the weighting classes. The population weighting factors are shown in Table 7

The population weighting factors were multiplied by the sample weights to produce a final pupil-level weight, which adjusts for both differing probabilities of selection and nonresponse, i.e.:

$$W_i^F = W_i^P \times W_i^{NR}$$

for any pupil i .

Table 7 Population weighting factors for survey sample

	Sample weighted by probability weight	% of total	Population 2003	Population weight factor	% of total
England					
Non-deprived					
age 5	318,656	16.4%	511,443	1.61	17.2%
age 8	307,270	15.8%	519,160	1.69	17.5%
age 12	353,826	18.2%	561,676	1.59	18.9%
age 15	349,631	18.0%	535,716	1.53	18.0%
Deprived					
age 5	59,074	3.0%	100,446	1.70	3.4%
age 8	56,588	2.9%	106,449	1.88	3.6%
age 12	50,677	2.6%	82,760	1.63	2.8%
age 15	51,905	2.7%	78,130	1.51	2.6%
Wales					
Non-deprived					
age 5	18,813	1.0%	30,332	1.61	1.0%
age 8	19,293	1.0%	29,941	1.55	1.0%
age 12	24,724	1.3%	34,920	1.41	1.2%
age 15	24,989	1.3%	33,531	1.34	1.1%
Deprived					
age 5	4,423	0.2%	4,987	1.13	0.2%
age 8	4,481	0.2%	6,026	1.34	0.2%
age 12	3,221	0.2%	3,056	0.95	0.1%
age 15	3,745	0.2%	3,061	0.82	0.1%
Scotland					
Non-deprived					
age 5	41,794	2.2%	43,863	1.05	1.5%
age 8	41,268	2.1%	46,472	1.13	1.6%
age 12	63,236	3.3%	56,110	0.89	1.9%
age 15	59,620	3.1%	50,247	0.84	1.7%
Deprived					
age 5	4,931	0.3%	13,029	2.64	0.4%
age 8	3,093	0.2%	13,309	4.30	0.4%
age 12	3,208	0.2%	6,274	1.96	0.2%
age 15	3,320	0.2%	5,501	1.66	0.2%
Northern Ireland					
Non-deprived					
age 5	12,612	0.6%	17,284	1.37	0.6%
age 8	12,574	0.6%	17,357	1.38	0.6%
age 12	12,112	0.6%	18,095	1.49	0.6%
age 15	14,029	0.7%	18,267	1.30	0.6%
Deprived					
age 5	4,382	0.2%	5,728	1.31	0.2%
age 8	5,119	0.3%	5,888	1.15	0.2%
age 12	4,744	0.2%	7,425	1.57	0.2%
age 15	5,905	0.3%	7,862	1.33	0.3%

Appendix A The conduct of the examination and criteria for the assessments

This document describes in detail, the criteria for the conduct of the clinical examination in the pilot study for the Child Dental Health Survey 2003. It should be remembered that some assessments apply only to particular age groups. The sequence of the examination is as follows:

Developmental Defects of Enamel (12-year-olds only - natural light)

Simplified IOTN Aesthetic Component (12- and 15-year-olds only)

Perio I – Gingivae, plaque, calculus

Perio II – Gingivitis (15-year-olds only)

Tooth Condition

Trauma

Tooth surface loss/toothwear

Simplified IOTN Dental Health Component (12- and 15-year-olds only)

Orthodontic appliances

Anomalies

Asterisk/Comments

Prior to commencing the examination, examiners should confirm that the child's age conforms with the age categories qualifying for inclusion in the survey, i.e. age 5, 8 12 or 15 years. Therefore children born between the following dates are eligible for inclusion:

5-year-olds date of birth from September 1997 to August 1998

8-year-olds date of birth from September 1994 to August 1995

12-year-olds date of birth from September 1990 to August 1991

15-year-olds date of birth from September 1987 to August 1988

1. ENAMEL OPACITIES (ON 12-YEAR-OLDS ONLY)

Subjects should be examined from in front and in natural daylight, if possible. Any gross deposits should be wiped away from the teeth which should be examined wet. Delay in diagnosis allows further minute changes to take place through the drying of the tooth surface. The examination will be carried out on twelve-year old children on the following teeth:

4321|1234

Teeth should be identified first and then coded. On anterior teeth the labial surfaces will be examined. On premolars the buccal surfaces (starting in the

middle of the mesial surface and extending to the middle of the distal surface) will be examined. A mouth mirror will aid the diagnosis of upper premolar teeth. The sequence of examinations is from upper left to upper right. Tooth surfaces should be inspected visually for defects and if in doubt areas such as hypoplastic defects should be explored with a probe to confirm a diagnosis. Movement of the examiner's line of vision helps to provide different examining positions in order to see defects.

Any single defect less than 1mm in diameter should not be recorded. White spot decay can usually be recognised by experienced clinicians from its location and the condition in the mouth. White cuspal and marginal ridges on premolar teeth and similar ridges on lateral incisors can be mistaken for diffuse opacities. If in any doubt about the presence of a defect the tooth surface should be scored normal. Any enamel defect which cannot be readily classified into the three basic types of defects **Demarcated**, **Diffuse Opacities** or **Hypoplasia** should be scored "Other".

Demarcated opacity

A defect involving an alteration in the translucency of the enamel, variable in degree. The defective enamel is of normal thickness with a smooth surface. It has a distinct and clear boundary with the adjacent normal enamel and can be white, cream, yellow or brown in colour. The lesions vary in extent, position on the tooth surface, and distribution in the mouth. Some maintain a surface translucency while others are dull in appearance.

Diffuse opacity

Also a defect involving an alteration in the translucency of the enamel, variable in degree. The defective enamel is normal thickness and at eruption has a relatively smooth surface and is white in colour. It can have a linear, patchy or confluent distribution but there is no clear boundary with the adjacent normal enamel.

Lines: Distinctive white lines of opacity which follow the lines of development of the teeth. Confluence of adjacent lines may occur.

Patchy: Irregular, cloudy areas of opacity lacking well defined margins.

Confluent: Diffuse patchiness has merged into a chalky white area extending from mesial to distal margins which can cover the entire surface or be confined to a localised area of the tooth surface.

Hypoplasia

A defect involving the surface of the enamel and associated with a reduced localised thickness of enamel. It can occur in the form of (a) pits – single or multiple, shallow or deep, scattered or in rows of pits arranged horizontally across the tooth surface; (b) grooves – single or multiple, narrow or wide (max 2mm), or partial or complete absence of enamel over a considerable area of dentine. The enamel of reduced thickness may be translucent or opaque.

Extent of defect

The extent of a surface area covered by a defect is derived by visually condensing all the areas affected by a defect and then relating the total area affected to that of the total visible surface area, and coded as occupying less than one third, one third to two-thirds or two-thirds or more of the surface.

Type of defect

Code 0	Normal
Code 1	Demarcated Opacity
Code 2	Diffuse Opacity
Code 3	Hypoplasia
Code 4	Demarcated + Diffuse
Code 5	Demarcated + Hypoplasia
Code 6	Diffuse + Hypoplasia
Code 7	All three defects
Code 8	Other Defects
Code 9	Assessment cannot be made

Extent of defect

Code 0	Normal
Code 1	Less than one third
Code 2	At least one third – two-thirds
Code 3	At least two-thirds
Code 9	Assessment cannot be made

If more than two-thirds of a tooth surface is heavily restored, badly decayed or fractured then it should not be examined. When a defect has been classified as to its type then the extent of the defect is recorded. If two different types of defect are present then the extent will relate to the combined size of the two defects.

Symmetry of diffuse enamel defects

When the type and extent of the defect has been recorded, if diffuse defects (either diffuse alone or in combination with demarcated or hypoplastic defects) are present then a record should be made as to whether they are symmetrically distributed about the midline.

Code 0 = No diffuse defects

Code 1 = Diffuse defects (either alone or in combination with demarcated or hypoplastic defects) but not symmetrically distributed about the midline

Code 2 = Diffuse defects (either alone or in combination with demarcated or hypoplastic defects) symmetrically distributed about the midline

Photographic assessment of impact score for diffuse defects.

An assessment of the severity of diffuse defects should be made by reference to the standard photograph.

Select the most severe diffuse defect and compare it to the photograph.

Code 0 No diffuse defects

Code 1 Non-symmetrical diffuse defects

Code 2 Diffuse defect – similar to or less severe than photograph

Code 3 Diffuse defect – more severe than the photograph

Code 9 Assessment cannot be made

2 SIMPLIFIED IOTN –AESTHETIC COMPONENT

(12- and 15- year- olds only. Children wearing an orthodontic appliance are excluded from assessment).

The Simplified Index of Orthodontic Treatment Need (IOTN) consists of two separate components:

The Aesthetic Component

Determines the level of need for orthodontic treatment on aesthetic grounds.

The Dental Health Component

Determines the level of need for orthodontic treatment on dental health grounds.

Each component is assessed independently, the scores from each component are not added together. Some subjects may have a definite need for orthodontic treatment on aesthetic grounds but no need on dental health grounds. Similarly, some children may have a need for orthodontic treatment on dental health grounds, but not on aesthetic grounds. The aesthetic component is scored now. The dental health component is scored in Section 7.

The following section summarises how the IOTN score for the aesthetic component should be recorded. The approach outlined will enable the examiner to record the IOTN score for the vast majority of malocclusions.

The Aesthetic Component

(i) The anterior teeth should be rated on their dental attractiveness as seen. Stained teeth, enamel fractures and gingival inflammation should be ignored.

(ii) Ask the subject to close together on their back teeth. Then retract the lips to expose the anterior teeth. The dental attractiveness is then rated using the 10 point Aesthetic Component scale. Grades 8-10 represent a definite need for orthodontic treatment on aesthetic grounds.

(iii) When using the Aesthetic Component scale, a ranking is awarded for overall dental attractiveness rather than specific morphological similarity to the photographs.

Completing the form for Orthodontic Assessment

The Aesthetic Component

Grades 1–10

Please write a single number in each box, so that Grade 1 is written as 01.

3. PERIO I

Gingival health, plaque, calculus (all children)

For these assessments each jaw is divided into three segments, as follows:

The middle segment: extending forwards from the distal surface of the canine on one side around to the distal surface of the canine on the other side.

The left and right segments: extending backwards from the distal surfaces of the canines to the distal surfaces of the most posterior teeth present.

The examiner will look at each of these segments in the prescribed order (upper left, upper middle, upper right, lower right, lower middle, lower left) three times; once for the assessment of the gum condition, once for estimating the amount of plaque on the teeth and once to determine the presence or absence of calculus. The average condition of the gums or plaque in the segment should be recorded and not the worst area in that segment.

IT MUST BE STRESSED THAT WHEN THERE IS DOUBT ABOUT THE CLASSIFICATION OF ANY CONDITION, THE LOWER CATEGORY SHOULD BE RECORDED.

Gingival health

Each segment will be examined both buccally and lingually and its state recorded according to one of the following categories:

Code 0 The gingivae appear healthy. (No treatment is needed).

Code 1 The gingivae are not healthy.

Code 9 Assessment cannot be made.

(Code 1 includes **both** gingivitis that can be reversed by prophylaxis and improved oral hygiene **and** more severe redness and swelling of the gingivae).

Plaque

Each segment will be examined visually both buccally and lingually and its state coded according to one of the following categories:

Code 0 The teeth appear clean.

Technical Report

Code 1 Plaque visible without probing.

Code 9 Assessment cannot be made.

(A probe is **not** used for this part of the examination. Consider plaque only – ignore recent debris such as small pieces of crisp found in an otherwise clean mouth immediately following a school breaktime).

Calculus

Each segment will be examined visually and the presence of calculus recorded as follows:

Code 0 No calculus

Code 1 Calculus is present

Code 9 Assessment cannot be made

3b. PERIO II

Gingivitis (15-year-olds only)

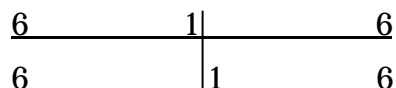
Please ask the following question before starting this part of the examination:

“Do you carry a medical card or has anyone ever advised you to pass on any information to a dentist?”

If the answer is “**YES**” you **MUST** exclude this subject from this part of the survey.

Gingivitis

The assessment of gingivitis will be made on the following permanent teeth:



If one, or more of the first molars are missing then the second molar(s) should be examined instead. If the upper right central incisor is missing, examine the upper left central incisor. If the lower left central incisor is absent examine the lower right central incisor. If both upper central incisors, or both lower central incisors, or one of the substituted second molars are missing, the assessment should be abandoned for that particular segment, and a score of 9 recorded.

The examination should be carried out in the same sequence as before (upper left, upper middle, upper right, lower right, lower middle and lower left). A new sterile periodontal probe will be used in all children if needed as part of the examination. The periodontal probe should be gently inserted into the sulcus or pocket on the distal of each designated tooth and run around the buccal sulcus of the upper tooth, and the lingual sulcus of the lower tooth, to the mesial surface.

The gingivae in relation to these teeth will then be examined in the same sequence as previously, for any evidence of bleeding recorded as:

Code 0 No bleeding from the gingival sulcus

Technical Report

Code 1 Bleeding from the gingival sulcus

Code 9 Assessment cannot be made

NO PROBE WILL BE USED ON A SECOND CHILD WITHOUT SATISFACTORY
STERILISATION

4. TOOTH CONDITION

Teeth will be examined in the following order:

Upper left – upper right – lower right – lower left.

In the first instance the tooth will be identified and ringed. If a primary tooth is missing, record the state of the permanent successor. In cases where both the primary tooth and its permanent successor are present further details will be recorded for the permanent tooth only.

Permanent teeth may be **Absent** for a number of reasons in which case code all surfaces as follows:

Code 8 Unerupted (or congenitally missing)

Code 6 Extracted due to caries

Code 7 Extracted for orthodontic reasons

Code T Missing due to trauma

In most cases the reason for the absence of a permanent tooth will be obvious and the appropriate code may be called and recorded at once. Sometimes questioning the child will be necessary, for example – “Did you have those teeth taken out to make room for the others?” “Was that front tooth knocked out?”

A tooth is deemed to be **Present** if any part of it is visible.

Tooth surfaces

If a tooth is present, each surface will be examined, coded and called in the following order:

Distal – occlusal – mesial – buccal – lingual.

(In the cases of anterior teeth ‘occlusal’ is, of course, omitted.)

Obscured surfaces (e.g. by an orthodontic band) will be assumed to be sound unless there is clear evidence to the contrary.

N.B. WHERE DOUBT EXISTS IN THE DIFFERENTIATION BETWEEN THE CATEGORIES, THE LESS SEVERE CATEGORY SHOULD ALWAYS BE CALLED.

The surface coding is as follows:

Code O Present and “sound”

Code O (Zero) is used for all surfaces that are present and have no caries experience. A surface is recorded as “sound” if it shows no evidence of treated or

Technical Report

untreated dental caries in dentine. In the case of partly-erupted teeth, where some surfaces may not be visible, these will be considered as sound and recorded under this category.

Code 2V Visual caries (non cavitated dentine caries)

The surface has caries present into dentine which is visible to the observer, but which is not obviously cavitated. This usually manifests as shadowing under an occlusal surface or marginal ridge.

Code 2C Cavitated dentine caries

The surface has a carious lesion into dentine which has caused the lesion to cavitate. Record 2C only if there is a cavity (but not 3 below). (Hard "arrested" caries into dentine is included in this category.) Lesions or cavities containing a temporary dressing, or cavities from which a restoration has been lost, will be coded in the appropriate category of decayed.

Code 3 **Decay with pulpal involvement**

Surfaces are regarded as falling into this category if, in the opinion of the examiner, there is a carious cavity that involves the pulp, necessitating an extraction or pulp treatment.

Code 4V Filled and recurrent decay (no visual cavitation)

A surface that has a carious lesion and a restoration (whether or not the lesion is in physical association with the restoration) will fall into this category if there is visible dentine caries but no cavitation (similar to code 2V).

Code 4C Filled and recurrent decay (cavitation present)

A surface that has a carious lesion and a restoration (whether or not the lesion is in physical association with the restoration) will fall into this category if there is visible caries with cavitation to dentine (similar to code 2C). Unless the lesion is so extensive as to be classified as "decay with pulpal involvement", in which case the filling would be ignored and the surface classified Code 3.

Code 5 Filled with no dentinal decay

Surfaces containing a satisfactory permanent restoration (excluding crowns and bridge abutments) of any material will be coded under this category.

Code R Filled, needs replacing (not carious into dentine)

A filled surface is regarded as falling into this category if, in the opinion of the examiner after inspection, it is chipped or cracked and needs replacing, but there is no "caries into dentine" present on the same surface.

Code t Traumatized surface

Surfaces affected by trauma, including those that are restored, will be coded in this category.

Code S Obviously sealed surfaces

Technical Report

The probe will be used to assist in the detection of sealants. (Care should be taken to differentiate sealed surfaces from those restored with tooth coloured filling materials used in prepared cavities which have defined margins. These should be regarded as fillings and are coded 4V, 4C, 5 or R.) Sealant codes should only be used if the surface contains obvious evidence of a sealant (including cases with partial loss of sealant), is otherwise sound and does not also contain an amalgam or other filling.

Code C Crown/advanced restorative procedures

This code is used for all surfaces which have been permanently crowned or which have received permanent items of advanced restorative care in the form of a veneer or a restoration constituting a bridge abutment. This is irrespective of the materials employed (and should include stainless steel crowns) or of the reasons leading to the placement of the crown/veneer/bridge. (Note: missing teeth replaced by a bridge are coded T, 6 or 8 as for other absent teeth (congenitally missing teeth are coded 8)).

5. TRAUMA OF PERMANENT INCISORS

Examine and code each incisor according to the following categories:

- Code 0 No trauma
- Code 1 Discolouration
- Code 2 Fracture involving enamel
- Code 3 Fracture involving enamel and dentine
- Code 4 Fracture involving enamel, dentine and pulp
- Code 5 Missing due to trauma
- Code 6 Acid-etch composite restoration
- Code 7 Permanent replacement including crown, denture, bridge
pontic
- Code 8 Temporary restorations
- Code 9 Assessment cannot be made

6. TOOTH SURFACE LOSS / TOOTHWEAR OF INCISORS AND FIRST PERMANENT MOLARS

The **buccal** and **lingual** surfaces of primary and permanent maxillary incisor teeth and the occlusal surfaces of the first permanent molar teeth will be assessed for loss of surface enamel characteristics, and/or exposure of dentine or pulp.

DO NOT consider the incisal edge.

BA|AB

6	2	1	1	2	6
6				6	

Assess the **Depth** and **Area** of loss of tooth tissue for each surface using the following criteria:

Depth:

Code 0	Normal
Code 1	Enamel Only – loss of surface characterization
Code 2	Enamel and Dentine – loss of enamel, exposing dentine
Code 3	Enamel into Pulp – loss of enamel and dentine resulting in pulpal exposure
Code 9	Assessment cannot be made

Area:

For each affected surface assess by area:

Code 0	Normal
Code 1	Less than one third of surface involved
Code 2	One third – up to two thirds of surface involved
Code 3	More than two thirds of surface involved
Code 9	Assessment cannot be made

7. SIMPLIFIED IOTN – DENTAL HEALTH COMPONENT

(12- and 15- year- olds only. Children wearing an orthodontic appliance are excluded from assessment)

The Dental Health Component

Determines the level of need for orthodontic treatment on dental health grounds. This is assessed with the aid of metal ruler which has two lines inscribed – a white line at 4mm and a red line at 6mm.

Each component is assessed independently, the scores from each component are not added together. Some subjects may have a definite need for orthodontic treatment on aesthetic grounds but no need on dental health grounds. Similarly, some children may have a need for orthodontic treatment on dental health grounds, but not on aesthetic grounds.

The following section summarises how the IOTN scores for the dental health component should be recorded. The approach outlined will enable the examiner to record the IOTN score for the vast majority of malocclusions.

The Dental Health Component normally comprises a 5-point scale:

Grades 1-3 represent no need or borderline need for orthodontic treatment on dental health grounds.

Grades 4 and 5 represent a definite need for orthodontic treatment on dental health grounds.

The Dental Health Component of IOTN has been simplified for use in screening surveys such as those undertaken by BASCD. Essentially, IOTN Grades 1-3 are coded as 0 and Grades 4 and 5 coded as 1. Therefore, only definite need for treatment is recorded and borderline need is incorporated into the no need categories.

A small metal ruler is used to measure overjets, crowding and open bites.

Examine each subject in a systematic manner for the following 5 occlusal traits:

Missing teeth (ectopic canines, congenital absence).

Overjet (both increased and reverse overjets).

Crossbite.

Displacement of contact points (crowding).

Overbite (both increased overbite and open bite).

The acronym 'MOCDO' can be constructed from the first letter of each category. This may be used to remember the scale of occlusal traits.

During the examination, if any malocclusion is present according to the criteria, a Code 1 is recorded. Once a Code 1 is recorded, the examination is complete and no further categories need to be examined for on the MOCDO scale.

Missing teeth

Congenital absence/traumatic loss

The examiner must first decide if orthodontic treatment is required to either open space for a prosthesis or to close the space completely.

If orthodontic treatment is required, then the subject is recorded as being in the definite need category of the Dental Health Component and Code 1 = malocclusion present is recorded.

Ectopic teeth

Ectopic upper canines are most often recorded in this section. If an upper canine is not present in the arch (and there is no history of extraction) the examiner should examine/palpate the buccal sulcus for normal canine position, i.e. a 'canine bulge' should be palpable. If no canine bulge is palpable, then the canine is assumed to be palatally ectopic and a definite need for orthodontic care is recorded, Code 1.

Impacted teeth

Third molars are not included in this assessment.

No part of the tooth should be visible in the mouth.

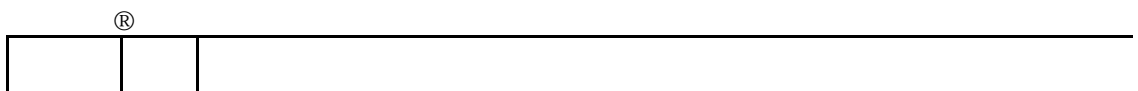
Technical Report

This section usually applies to impacted canines or second premolars. An impacted tooth is recorded in IOTN when there is 4 mm or less space between adjacent erupted teeth (Code 1 = malocclusion present).

During the survey radiographs are not available, therefore it can sometimes be difficult to determine if a tooth is congenitally missing or impacted. Congenital absence of permanent canines is rare. Congenital absence of second premolars is more common. Careful clinical examination/palpation of the alveolus may help to confirm the presence of an unerupted second premolar.

Positive overjets

- (i) Use the end of the metal ruler which has two lines.



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6 mm

- (ii) Hold the metal ruler parallel to the occlusal plane.
- (iii) Measure to the labial aspect of the most prominent incisor. On some occasions, the lateral incisor may be the most prominent incisor.
- (iv) A definite need for orthodontic treatment (code 1 = malocclusion present) is recorded if the overjet extends beyond the second line (6 mm, red line).
- (v) If the overjet falls exactly on the line, do not record in the definite need category and score Code 0 = malocclusion absent.

Reverse overjets

(i) Use the first line of the metal ruler to measure reverse overjets (4 mm, white line).

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4mm

(ii) A reverse overjet is defined as all four upper incisors in lingual occlusion.

(iii) Unlike positive overjet, if the reverse overjet falls exactly on the 4 mm line, then record in the definite need for treatment category, code 1 = malocclusion present.

(iv) A definite need for orthodontic treatment (Code 1) is also recorded if the subject reports eating or speaking difficulties associated and their reverse overjet is greater than one millimetre.

Crossbites

(i) Can be anterior or posterior

(ii) The IOTN Dental Health Component need for treatment depends on the amount of transverse or antero-posterior displacement that occurs on closure.

Definite Need for Treatment = > 2mm displacement

(Code 1 = malocclusion present)

Displacement of contact points (crowding)

Measure between the anatomical contact points of the two most crowded teeth.

Using the metal ruler, determine if any adjacent contact points are greater than 4mm apart. The first line (4mm, white of the metal ruler) is used in this assessment. If contact points of permanent teeth are further than 4mm apart, then a definite need for treatment is recorded (Code 1 = malocclusion present).

Only measure crowding between permanent teeth. Do not measure between deciduous teeth or between deciduous teeth and permanent teeth.

Rotations of premolar and molar teeth are not included in this section. Hold the ruler parallel to the occlusal plane when making these measurements.

Deep overbite

A definite need for treatment is recorded (Code 1) if there is evidence of trauma to the gingival margin, either on the palatal aspect of the upper incisors or the buccal aspect of the lower incisors.

Open bite (anterior or posterior)

Only record 'true' open bites, do not include developmental open bites.

Determine if the open bite is greater than the first line (4 mm, white) – Definite Need for Treatment, Code I.P.

Other points

- (i) Generalised spacing is not recorded by the Dental Health Component.

Completing the form for Orthodontic Assessment

The Dental Health Component

Please write either 0 = malocclusion absent, or

1 = malocclusion present

in the single box.

8. ORTHODONTIC APPLIANCES

If the child is wearing an orthodontic appliance specify the type of appliance that is being worn. Consider each arch separately. Use the following categories:

Upper Arch	Lower Arch
Code 0	No appliance
Code 1	Fixed orthodontic appliance
Code 2	Removable orthodontic appliance
Code 3	Other. In this case describe the type of appliance in the section reserved for comments.

If the child is not wearing an appliance then ask whether or not he/she has worn one in the past. If the child has worn an appliance then ask whether they have finished wearing it.

Code 0	Never worn.
Code 1	The child has worn a fixed appliance in the past and has finished wearing it.
Code 2	The child has worn a removable appliance in the past and has finished wearing it.
Code 3	The child has worn an appliance in the past and is still wearing it.

9. SPECIFIC ANOMALIES

Does the child have any defects of cleft lip and/or palate or any other craniofacial anomalies?

Code 0	None
Code 1	Present – please specify in comments section

Has the child extensive hypodontia?

Technical Report

Code 0 None

Code 1 Extensive Hypodontia with restorative implications. (Please specify in the Comments section which teeth are missing.)

10. ASTERISK/COMMENTS

At any time during the examination if the dentist wishes to make comments he will call 'asterisk' to the recorder who will mark the form at that point.

On completion of the examination, if there are no asterisks marked, ask if the dentist wishes to make a comment. If there are any asterisks and/or the dentist does wish to make comments, hand the examination form to the dentist to record comments on the back.

Appendix B The Dental Team

Dental Schools

University of Birmingham:

Mr J Morris
Dr D White
Dr K Hill
Ms S Goucher

University of Dundee:

Dr N Nuttall
Prof. N Pitts

University of Newcastle upon Tyne:

Dr D Evans
Prof. J Steele
Ms J Smith

University of Wales:

Dr B Chadwick
Dr I Chestnutt

The Dentists

Ms S Abayarantne
Mr G Abel
Mr P Bainton
Ms L Bangham
Ms V Barret
Ms L Blair
Ms J Bray
Ms J Breckon
Mrs F Bridges
Mr G Brown
Mr W Challacombe
Ms E Clarke
Ms D Conlon
Mrs P Corrigan
Ms D Denton
Mr C Dugmore
Mr R Dyer
Mrs P Evans
Mr R Evans
Ms C Falk
Ms M Ferguson
Mr J Fielding
Ms E Forbes
Ms F Francis
Ms J Fyfield
Mr P Garcha
Ms B Grundy
Ms N Hamid
Ms L Hawkes
Mr R Havelock
Mr P Helliwell
Miss H Humphries

Ms P Jackson
Ms J Jobbins
Ms D Johnston
Ms E Jones
Mr I Knowles
Ms M Langdale
Ms C MacCormac
Ms W Martin
Ms L Matthews
Mr J Mellor
Ms F M Morgan
Mr G O'Brien
Mr K Owen
Ms C Paige
Mr D Pal
Ms H Pearson
Mr P Pennington
Ms C Redmond
Mrs A Reynolds
Ms K Shah
Ms H Smithson-Whitehead
Ms S Snape
Mr P Stannard
Ms K Steel
Mrs M Stubbings
Ms F Sutton
Mrs D Tabari
Ms A Williams
Mr P Williams
Ms D Wright
Mr P Young
Mr S Zaro

The Nurses

Ms E Arthur
Ms S Ash
Ms B Bayliss
Ms L Beckett
Ms L Bicknell
Miss S Burke
Mrs P Childs
Ms D Clavin
Ms R Clements
Ms M Cole
Ms C Cowling
Ms S Demou
Ms A Donnelly
Ms K Douglas
Mrs L Dowson
Ms J Evans
Ms S Fagan
Ms H Gibbons
Mrs J Green
Ms B Hagues
Ms Y Harris

Ms H Hatherley
Ms R James
Ms T-A James
Ms D Jones
Mrs K Jubb
Ms L Laucey
Ms LA Legge
Ms S Marshall
Miss S Mickleburgh
Ms T Moran
Ms J Read
Ms J Roberts
Mrs L Roberts
Mrs K Robinson
Ms V Smith
Ms J Spinks
Mrs T Stocker
Ms J White
Mrs J Wilkinson
Ms L Wilson
Mrs J Woodberry

Appendix C Glossary of terms

Dental Term	Definition
Acid etch composite	A method used to repair fracture to the mesial or distal surfaces of the tooth. Acid etch composite tips are applied to preserve the contact point with the adjacent tooth.
Advanced restoration/ crown	A surface which has been permanently crowned or which has received permanent items of advanced restorative care in the form of a veneer or a restoration constituting a bridge abutment. This is irrespective of the materials employed (and should include stainless steel crowns) or of the reasons leading to the placement of the crown/veneer/bridge.
Anterior	Situated in the front of the mouth, a term commonly used to denote incisors and canine teeth.
Buccal surface	The surface of tooth adjacent to the cheek.
Calculus	A hard substance that forms both above and below that gum line. Occurs when plaque is left on the teeth untreated. Calculus harbours bacteria, which produce toxins and can cause the gums to become inflamed (gingivitis).
Canines	The teeth located just to the left and right of the lateral incisors, four in total.
Caries	See <i>dental caries</i> .
Central incisors	The first four front teeth, two located on the top and two on the bottom of the mouth.
Cleft lip/ palate	A cleft lip is a condition that creates an opening in the upper lip between the mouth and nose. It looks as though there is a split in the lip. It can range from a slight notch in the coloured portion of the lip to complete separation in one or both sides of the lip extending up and into the nose.
Cleft palate	A cleft palate occurs when the roof of the mouth has not joined completely. The result can range from just an opening at the back of the soft palate to a nearly complete separation of the roof of the mouth (soft and hard palate).
Craniofacial anomalies	Included under this heading are a rather large number of conditions that can affect the shape of a

	child's head and face.
Crossbite	A malocclusion where the upper teeth bite inside the lower teeth.
Crowding	A malocclusion caused by insufficient space for the teeth.
Crown	The crown is the part of the tooth which, on a natural sound tooth, is covered in dental enamel.
Decay into dentine (D_{3c})	All teeth with cavities into dentine and teeth that had restorations with cavitated dentine caries. Excludes teeth with visual dentine caries or enamel caries present. Permanent teeth with cavities into dentine are assumed to be those that are currently in need of operative treatment. (In primary teeth the decision as to whether to fill, review or extract such teeth would be taken in the knowledge that they will exfoliate naturally at some point in the future.)
Decay into dentine (D_{3cv})	All teeth with cavitated or visual dentine caries present and teeth that had restorations with visual and cavitated dentine caries. Excludes teeth with enamel caries present.
Demarcated opacity	A non-carious defect involving an alteration in the translucency of the enamel, variable in degree. The defective enamel is of normal thickness with a smooth surface. It has a distinct and clear boundary with the adjacent normal enamel and can be white, cream, yellow or brown in colour. The lesions vary in extent, position on the tooth surface, and distribution in the mouth. Some maintain a surface translucency while others are dull in appearance.
Dentine	The hard inner layer of the tooth.
Diffuse opacity	Also a non-carious defect involving an alteration in the translucency of the enamel, variable in degree. The defective enamel is normal thickness and at eruption has a relatively smooth surface and is white in colour. It can have a linear, patchy or confluent distribution but there is no clear boundary with the adjacent normal enamel.
Discoloration	Any change in the hue, colour, or translucency of a tooth.
Displacement of contact points	Crowding of permanent teeth, determined if any adjacent contact points are greater than 4mm apart. Only measure crowding between permanent teeth.

(crowding)

Distal surface	The surface of the tooth away from the mid-line.
Ectopic teeth	Ectopic eruption happens when permanent teeth erupt through gum tissue behind or in front of deciduous teeth.
Enamel	The hard calcified tissue which covers the dentine of the crown portion of a tooth. Enamel is the hardest tissue in the human body.
Enamel opacities	A non-carious defect involving an alteration in the translucency of the enamel.
Filled, otherwise sound, teeth	Teeth with amalgam, or other, fillings that had no cavitated or visual dentine caries present (pre 2003 criteria exclude visual caries).
Fissure sealant	A material, usually a resin, which has been placed in the pits and fissures of teeth to protect against the development of caries. Sealants are also used in conjunction with filling materials.
Fluoride	A chemical substance that can strengthen tooth enamel and make teeth less susceptible to decay. Fluoride can make its way to teeth by ingestion through food or water, or by topical application made directly to the surface of the teeth by the dentist.
Gingivitis	Stage one of early periodontal disease characterized by inflammation, swollen, reddish gum tissue which may bleed easily when touched or brushed. Untreated, gingivitis can lead to chronic periodontal disease.
Hypoplasia	A non-carious defect involving the surface of the enamel and associated with a reduced localised thickness of enamel. It can occur in the form of (a) pits – single or multiple, shallow or deep, scattered or in rows of pits arranged horizontally across the tooth surface; (b) grooves – single or multiple, narrow or wide (max 2mm), or partial or complete absence of enamel over a considerable area of dentine. The enamel of reduced thickness may be translucent or opaque.
IOTN	The Index of Orthodontic Treatment Need.
Lateral incisors	The teeth located just to the left and right of the central incisors, four in total.
Lingual surface	The surface of tooth adjacent to the tongue.

Malocclusion	Abnormal occlusion of the teeth or jaws.
Mandible	The lower jaw.
Maxilla	The upper jaw.
Mesial Surface	The surface of the tooth towards the mid-line of the tooth.
Missing due to decay	Teeth that had been extracted due to caries.
Missing teeth	Teeth which were not present or visible in the mouth at the time of the examination. Missing teeth includes those which had been extracted and those which were unerupted.
Molars	The class of teeth found in the back of the mouth, characterised as having multiple biting surfaces.
Obvious decay experience (D_{3cv}MFT)	All teeth with cavitated or visual dentine caries, restorations with cavitated or visual dentine caries, teeth with filled decay (otherwise sound) and teeth extracted due to caries. Excludes teeth with enamel caries present. The term obvious decay experience relates to teeth with dentinal cavities, missing teeth and filled teeth in the DMFT dental decay index.
Obvious decay experience (D_cMFT)	All teeth with cavitated dentine caries, restorations with cavitated dentine caries, teeth with filled decay (otherwise sound) and teeth extracted due to caries. Excludes teeth with visual dentine caries or enamel caries present. The term obvious decay experience relates to teeth with dentinal cavities, missing teeth and filled teeth in the DMFT dental decay index.
Obviously sealed surface	The surface contains obvious evidence of a sealant (including cases with partial loss of sealant), is otherwise sound and does not also contain an amalgam or other filling.
Occlusal surface	The biting surface of posterior teeth.
Occlusion	The meeting together of the upper and lower teeth and jaws.
Orthodontic appliance	An appliance such as a brace used to help straighten teeth
Overbite	The vertical overlap of the upper over the lower teeth.

Overjet	The horizontal overlap of the upper teeth over the lower teeth.
Plaque	A sticky fairly transparent film that forms on the teeth or cracks of the teeth primarily composed of undigested food particles mixed with saliva and bacteria. Plaque left alone eventually turns in to tartar or calculus.
Posterior	Situated at the back of the mouth, refers to the premolar and molar teeth.
Premolars	Transitional teeth located between the canine and molar teeth, two per quadrant identified as first and second premolars.
Pulp	The internal part of the tooth that contains nerves and blood vessels.
Restoration	A tooth restoration is any artificial substance or structure that replaces missing teeth or part of a tooth in order to protect the mouth's ability to eat, chew, and speak. Restorations include fillings, inlays, crowns, bridges, partial and complete dentures, and dental implants.
Restoration	The material end result of operative procedures that restore the form, function and appearance of a tooth.
Simplified IOTN	Simplified Index of Orthodontic Treatment Need (IOTN) consists of two separate components:
-aesthetic component	Determines the level of need for orthodontic treatment on aesthetic grounds.
-dental health component	Determines the level of need for orthodontic treatment on dental health grounds.
Sound and untreated teeth	This term is used for all surfaces that are present and have no caries experience. A surface is recorded as "sound" if it shows no evidence of treated or untreated dental caries in dentine.
Tooth surface loss (tooth wear)	Loss of tooth surface that is not due to dental decay. May be caused by erosion, abrasion, attrition or stress lesions.
Trauma	An injury to the teeth or jaws.
Traumatized surface	Surfaces affected by trauma, including those that are restored, are in this category.
Unerupted teeth	Teeth that have not yet erupted and no tooth

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Overbite	The vertical overlap of the upper over the lower teeth.
Overjet	The horizontal overlap of the upper teeth over the lower teeth.
Plaque	A sticky fairly transparent film that forms on the teeth or cracks of the teeth primarily composed of undigested food particles mixed with saliva and bacteria. Plaque left alone eventually turns in to tartar or calculus.
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Technical Report

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Trauma	An injury to the teeth or jaws.
Traumatised surface	Surfaces affected by trauma, including those that are restored, are in this category.
Unerupted teeth	Teeth that have not yet erupted and no tooth surfaces are visible.