



Prevention and management of dental decay in the pre-school child

A national clinical guideline

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November 2005

KEY TO EVIDENCE STATEMENTS AND GRADES OF RECOMMENDATIONS

LEVELS OF EVIDENCE

1 ⁺⁺	High quality meta-analyses, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias
1 ⁺	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1 ⁻	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2 ⁺⁺	High quality systematic reviews of case control or cohort studies High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2 ⁺	Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2 ⁻	Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3	Non-analytic studies, eg case reports, case series
4	Expert opinion

GRADES OF RECOMMENDATION

Note: The grade of recommendation relates to the strength of the evidence on which the recommendation is based. It does not reflect the clinical importance of the recommendation.

A	At least one meta-analysis, systematic review of RCTs, or RCT rated as 1 ⁺⁺ and directly applicable to the target population; <i>or</i> A body of evidence consisting principally of studies rated as 1 ⁺ , directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2 ⁺⁺ , directly applicable to the target population, and demonstrating overall consistency of results; <i>or</i> Extrapolated evidence from studies rated as 1 ⁺⁺ or 1 ⁺
C	A body of evidence including studies rated as 2 ⁺ , directly applicable to the target population and demonstrating overall consistency of results; <i>or</i> Extrapolated evidence from studies rated as 2 ⁺⁺
D	Evidence level 3 or 4; <i>or</i> Extrapolated evidence from studies rated as 2 ⁺

GOOD PRACTICE POINTS

<input checked="" type="checkbox"/>	Recommended best practice based on the clinical experience of the guideline development group
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1 Introduction

1.1 BACKGROUND

Pre-school children in Scotland have amongst the highest rates of decayed teeth in Europe. The mean number of decayed, missing or filled teeth for a five year old child in Scotland is 2.7 compared with 1.6 for the whole of the UK.¹ Fifty five per cent of Scottish five year olds have decayed teeth, and less than 10% of these cavities are restored.¹ Dental extraction is sometimes the only treatment option, and 14% of five year olds in Scotland have had at least one tooth extracted. This rises to 42% of eight year olds.² For an entirely preventable disease, this is an unacceptable burden for a population to carry, both in terms of social costs (pain, distress) and economic costs (general anaesthesia, parental time off work). Failure to prevent dental decay in the pre-school child effectively, through modifying poor dental related behaviour of both child and parent, will generally condemn the majority of affected children to a lifetime cycle of dental treatment; with dental fillings followed by repeat fillings as the restorations fail over time.

1.2 THE NEED FOR A GUIDELINE

Dental decay can be prevented. When it does occur, there are effective treatments for preventing the decay from causing pain and eventual tooth loss. This guideline provides members of the dental team, health visitors, community workers, nursery staff, parents, and others with an interest in improving child dental health, with ready access to the best evidence based practice in the prevention and management of dental decay in the pre-school child.

1.3 REMIT OF THE GUIDELINE

The guideline addresses effective strategies for preventing and managing dental decay in the pre-school child. The nature of dental decay and its diagnosis are discussed, along with the epidemiology of the disease. Methods of preventing and managing the disease, at both the individual and population level, are reviewed. The identification of children at increased risk of developing dental decay is discussed, allowing appropriate targeting of available resources. The guideline should be of interest to all those involved in children's health and development.

1.4 STATEMENT OF INTENT

This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the dental practitioner, following discussion of the options with the child's parents or carers, in light of the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

1.5 REVIEW AND UPDATING

This guideline was issued in 2005 and will be considered for review in three years. Any updates to the guideline in the interim period will be noted on the SIGN website: www.sign.ac.uk

2 Pathogenesis and diagnosis

2.1 DIAGNOSTIC LEVELS AND TERMINOLOGY

Dental decay, also known as dental caries, is defined as a disease of the hard tissues of the teeth caused by the action of microorganisms, found in plaque, on fermentable carbohydrates (principally sugars). At the individual level, caries is a preventable disease. Given its dynamic nature the disease, once established, can be arrested or reversed prior to significant cavitation taking place.³

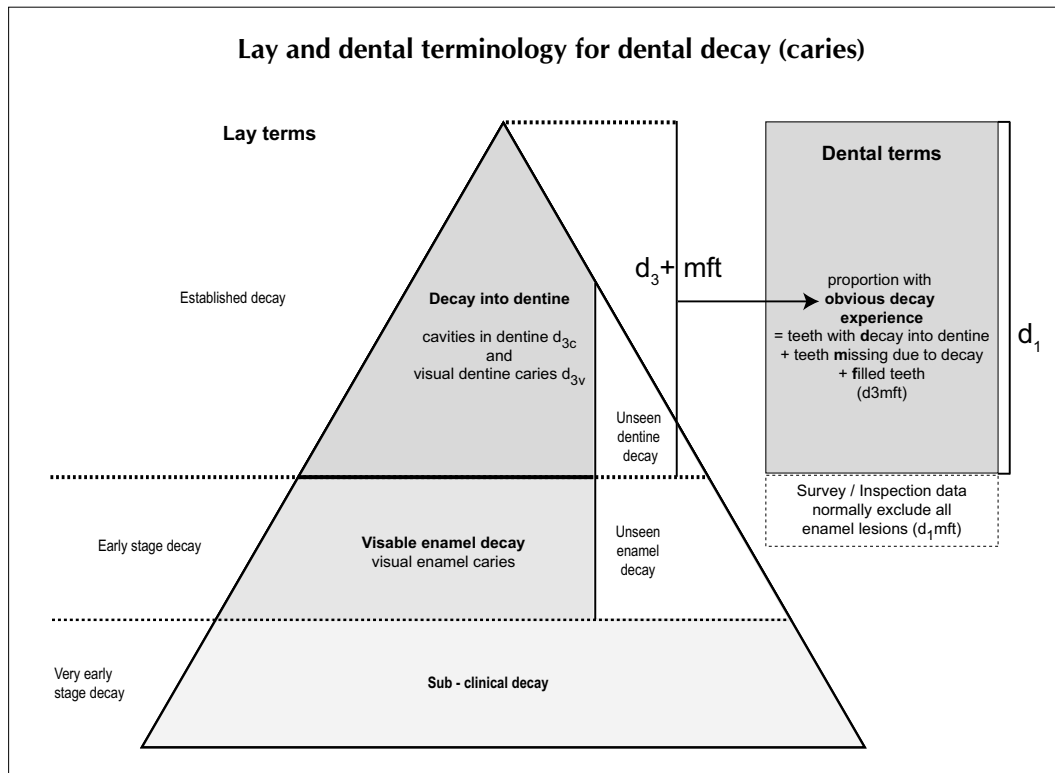
The carious process is essentially the same in the primary (milk teeth) and secondary (permanent teeth) dentitions. The majority of available research is based on work carried out on the secondary dentition, requiring extrapolation to the primary dentition. Anatomical differences between the two dentitions result in differences in the tooth surfaces affected by caries, in the type of teeth predisposed to caries, and in the rate of caries progression. The approximal surfaces are more prone to decay than the occlusal surface in primary teeth but not in permanent teeth. The relatively thinner enamel and dentine layers present in the primary dentition may result in earlier pulpal involvement when compared to the permanent dentition.^{1,4,5}

When caries principally affects the labial surface of the upper anterior teeth in pre-school children, it is often termed early childhood caries (ECC). Systematic review of the evidence suggests that the aetiology of early childhood caries is multifactorial.^{6,7}

2.2 THE PATHOGENESIS OF DECAY

The terminology of the various stages of dental caries has been described using the metaphor of an iceberg (see Figure 1).⁸

Figure 1: Iceberg diagram of dental terminology



Much of the caries-related data presented and discussed in this guideline is reported at the obvious decay experience level (see *Figure 1*).

Obvious decay experience is expressed as the dmf index, which is the sum of the number of teeth which, at the time of the examination, had decay into dentine (d_3), the number of teeth missing due to decay (mt) and the number of filled teeth (ft).

In the primary dentition, an assessment of teeth missing due to decay is complicated by the natural exfoliation of teeth, which commences at six years of age, so that d_3 is usually reported in the literature for five year old children.

Following international convention, a subscript is used to denote the level or threshold of disease. The symbol d_3 denotes clinically detectable decay into dentine. Individual thresholds can also be subdivided according to whether the lesions were cavities (d_{3c}) or seen as visual caries into dentine (d_{3v}). d_3 does not give an indication of any early stage decay. Clinically detectable decay into enamel is denoted d_1 .

2.3 EARLY DIAGNOSIS OF DENTAL CARIES

Early diagnosis and monitoring of carious lesions facilitates intervention at a stage when lesion arrest or reversal may be attempted.⁹ Accurate diagnosis is important to allow a risk assessment to be made, as caries in the primary dentition is a predictor of caries in the permanent dentition (see *sections 4 and 8*).⁶ In the primary dentition, early diagnosis of approximal caries is particularly important, as the large pulp to crown ratio means that the pulp is involved in the majority of cases where the caries has extended to involve the marginal ridge.¹⁰

2+

Caries is diagnosed using a variety of methods, including visual, tactile, radiographic and electrical techniques.

A systematic review of both in vitro and in vivo methods of caries diagnosis, with histological examination of extracted teeth as the inclusion criteria, found no evidence to support the superiority of one diagnostic method or combination of methods over any other.¹¹

1+

Studies of caries pathogenesis have shown that the disease process is dynamic and, initially, reversible. In many tooth surfaces there will be very early stages of decay, and preventive agents such as fluoride (present in toothpaste or water) can act on subclinical and visible enamel decay to prevent progression to established decay.^{12,13}

3

B Caries should be diagnosed as early as possible to allow management before cavitation and pulpal involvement, and to identify caries-active patients and those at increased risk of caries in the future.

2.4 DIAGNOSTIC TECHNIQUES

2.4.1 CLINICAL EXAMINATION

Typical dental examinations of children in inspections and surveys are carried out in school based settings, nurseries or playgroups. The examination is usually limited to measuring established decay by assessing obvious decay into dentine. This type of examination excludes unseen (or hidden) lesions, as well as reversible, early stage decay, so that children reported in population surveys as having no obvious decay cannot always be considered as disease free.

A more accurate assessment also includes visible enamel decay. This requires optimal illumination and control of saliva, and such examinations are usually carried out in dental surgeries. Dental radiographs, or other diagnostic aids, may be used to find unseen lesions in both dentine and enamel.

2.4.2 BITEWING RADIOGRAPHS

Radiography is a valuable adjunct to visual examination in caries diagnosis, particularly for the detection of small non-cavitated approximal lesions amenable to preventive management.¹⁴ Guidelines published by the British Society of Paediatric Dentistry, and by the Faculty of General Dental Practitioners (UK), support the use of radiography for caries diagnosis in the primary dentition, particularly if the child is assessed as at increased caries risk.^{9,15} A survey of 303 general dental practitioners in the west of Scotland found that only 17% would consider taking bitewing radiographs for children below six years of age.¹⁶

4

Bitewing radiographs should not be used as a screening tool for dental caries, as the diagnostic yield for any individual must be balanced against the disadvantages of exposure to ionising radiation.¹⁷

1+

- D**
 - The use of bitewing radiography for caries diagnosis should be considered for pre-school children attending for dental care, particularly if they are assessed as being at increased risk of dental caries.
 - The timing of subsequent radiographic examinations should be based on the patient’s caries risk status.

2.4.3 OTHER DIAGNOSTIC TOOLS AND TRAINING

Other techniques to support caries diagnosis include laser fluorescence, temporary tooth separation and electric caries meters. Further evidence is required before these techniques can be recommended as adjuncts to traditional diagnostic methods.

A systematic review of laser fluorescence for caries detection concluded that the relatively high false positive rate limited its value as a principal diagnostic tool.¹¹

1+

One Scandinavian study has demonstrated increased diagnostic yield following additional training in caries diagnosis.¹⁷

2+

C Practitioners should receive training in clinical and radiographic caries diagnosis.

- A thorough clinical examination should be carried out on clean dried teeth.

2.5 PRACTICAL ISSUES

Making a diagnosis in a pre-school child can be complicated by the child’s ability to understand and cooperate.

The common clinical perception that children aged four or five are uncooperative with bitewing radiography has been shown to be untrue for the majority of children.^{18,19}

1+

2

- As thorough a caries diagnostic examination as the child’s level of cooperation permits should be performed.

3 Epidemiology and impact

3.1 INTRODUCTION

This section describes levels of dental caries in pre-school children, the extent to which caries varies within the community, how it is skewed towards particular sectors of the population and the levels of untreated decay.

Statistics relating to five year olds have been used as a proxy for dental health in pre-school children. This is a reasonable indicator of oral health for this age group as much of the disease observed at five years will have begun during the pre-school years.

3.2 LEVELS OF DENTAL CARIES IN PRE-SCHOOL CHILDREN IN SCOTLAND

Few epidemiological data have been collected for pre-school children, particularly for children under three years of age. Table 1 presents data from the UK National Diet and Nutrition Survey.²⁰ Up to the age of 3.5 years children had little decay but by the age 3.5-4.5 years half had some caries experience and 40% showed active (untreated) caries. Eight percent of 3.5-4.5 year olds had missing teeth due to caries and 17% had some decay involving the pulp.

Table 1: Frequency of decay in pre-school children in the UK²⁰

Age (years)	% with obvious decay experience at d_3 level
1.5-2.5	3
2.5-3.5	18
3.5-4.5	50

There have been substantial improvements in child dental health in the UK since 1983, with the percentage of children at age five with no obvious caries experience increasing from 25% to 45% by 2003. Caries levels in five year olds have plateaued in the last five to seven years.²¹

The Scottish National Dental Inspection Programme of 2003 showed that for five year old children the average number of decayed, missing or filled teeth (dmft) per child was 2.7.²¹ Fifty five per cent had visible dental caries, with five teeth affected on average.

Fourteen per cent of all five year olds in Scotland have at least one tooth extracted.¹ At this age children who have regular dental check ups have less caries experience than those who attend only when they have trouble with their teeth.² Among 3.5-4.5 year olds, children whose mothers visited the dentist regularly had less caries experience than those whose mothers only attended when they had dental trouble.²⁰ In Scotland 35% of 0-2 year olds and 66% of 3-5 year olds are registered with a dentist.²² Attendance varies with social class with more children where the head of household was in the manual category never having been seen by a dentist compared to those in the non-manual category.²⁰

The Care Index is used to give an indication of the proportion of children's teeth which are decayed but have been treated restoratively. It is derived from the number of filled teeth divided by the number of obviously decayed, missing and filled teeth, multiplied by 100%. This figure has fallen from 20% in 1983, to 9% in 2003, indicating a substantial increase in the proportion of untreated carious teeth over the last 20 years.²¹

The epidemiological data available for pre-school children with disabilities or special needs are generally restricted to individual medical conditions and its applicability is limited.

There is little evidence in the Scottish population of the variation in caries among ethnic minority groups although there was some evidence internationally that immigrant populations were at higher risk.²³

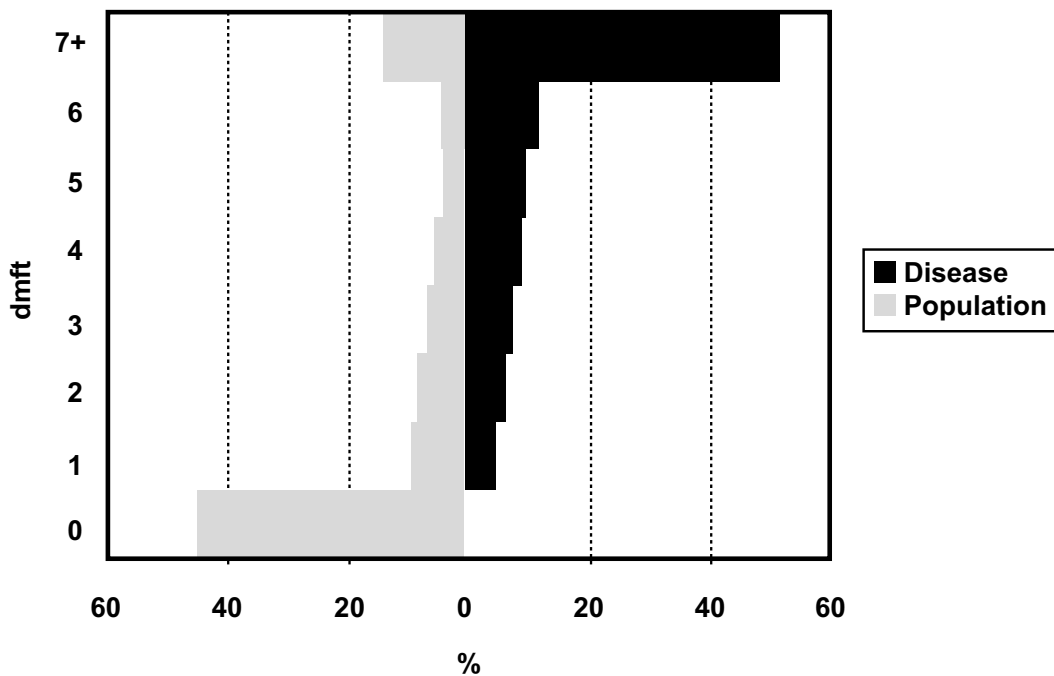
3.3 IMPACT OF DENTAL CARIES IN PRE-SCHOOL CHILDREN

Aside from aesthetic problems and loss of function, the main impact of untreated dental caries is pain and infection. There is little evidence as yet on the prevalence of dental pain in children in Scotland, but in a survey of eight year olds in Harrow (a region with a reduced dmft index compared with Scotland), 48% had experienced toothache, and for 18% their worst experience of toothache had made them cry.²⁴ The 1999 child dental health survey of 5 year olds in Scotland found that 14% of the children had already had at least one tooth extracted, yet despite this, 5% of children were still found to have evidence of dental sepsis (that is swelling or a discharging sinus) associated with carious teeth.¹

3.4 DISTRIBUTION OF CARIES

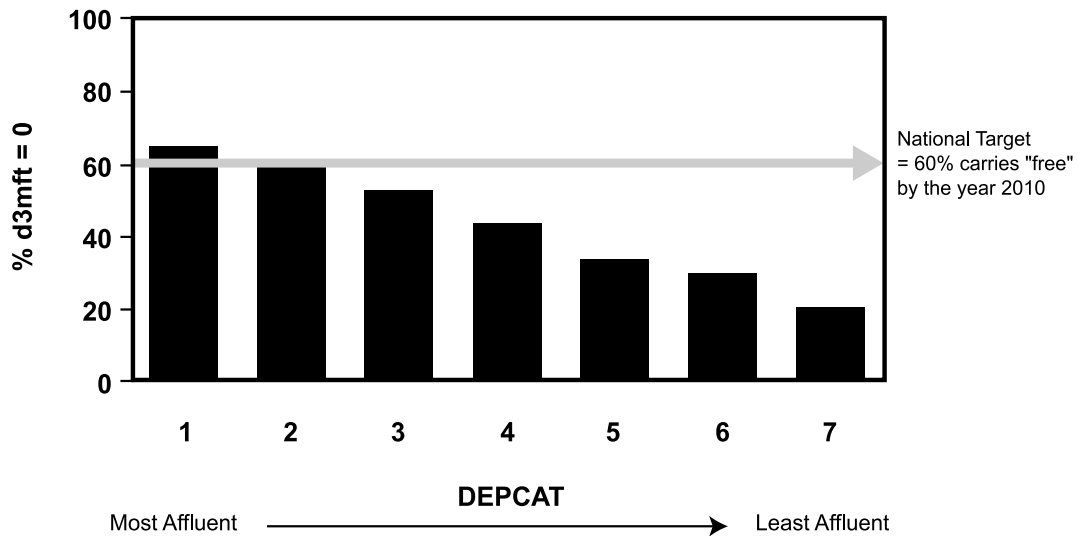
The incidence of dental caries is not evenly distributed through the population; 25% of children have 75% of the disease (Figure 2).

Figure 2: Distribution of dental caries (dmft) in 5 year olds in Scotland²⁵



Dental caries is also strongly related to poverty, showing an almost linear relationship with deprivation (Figure 3).²⁶

Figure 3: Percentage of 5 year olds in Scotland who are caries free related to deprivation category²⁶



Children in the most deprived areas have three times as much decay experience and are 30% less likely to have decay-free mouths at age five years than those living in more affluent communities.²⁵

- Preventive programmes should be designed to take account of the particular needs of children in deprived areas ensuring that access to service is facilitated and preventive care and advice is available.

4 Predicting caries risk

4.1 INTRODUCTION

There are two approaches to caries prevention: population based approaches, such as water fluoridation, and targeted prevention, either to individuals or to populations assessed as being at increased risk.²⁷

The detection of populations or individuals at increased risk of developing dental caries would allow preventive efforts to be focused on those most at risk of developing caries, in a cost effective fashion, without reducing the community wide benefits of preventive methods, such as oral health promotion – a so called “twin track” approach.

4.2 CARIES RISK INDICATORS

Caries risk assessment in pre-school children has been approached using a variety of tools:

- dietary factors (see section 5)
- oral hygiene factors (see section 6)
- microbiological risk factors
- sociodemographic markers
- previous caries experience.

4.2.1 MICROBIOLOGICAL RISK FACTORS

One cross-sectional and six cohort studies were identified. The authors concluded that caries in young children is associated with high oral levels of mutans streptococci.²⁸⁻³⁴

2⁺⁺

4.2.2 SOCIODEMOGRAPHIC RISK FACTORS

Data from studies on older children demonstrate that caries is most prevalent in children from low socioeconomic status families.³⁵ Infants living in areas of high deprivation have significantly more caries than those from more affluent areas.^{29,36}

2⁺⁺

One systematic review concluded that no relationship between low birth weight and caries development has been demonstrated.³⁷ One of the studies included in the review showed that low birth weight could be associated with enamel defects and caries in the primary dentition.³⁸ More research is required in this area before conclusions can be drawn.

2⁺⁺

No conclusive evidence was found to show that pre-school children with special needs are at increased caries risk.

4.2.3 PREVIOUS CARIES EXPERIENCE

Four cohort studies have shown that children with previous caries experience are at increased risk of future caries.^{23,39-41}

The majority of caries risk assessment studies have involved multiple risk indicators or interactions between these indicators. The most important risk indicators for caries identified in these cohort studies were previous caries experience and high levels of oral mutans streptococci.^{23,35,40-47}

2⁺⁺

4.2.4 RISK INDICATORS IN YOUNG CHILDREN

Potential risk factors for dental caries in children under seven years of age include; oral hygiene, diet, bacterial exposure, socioeconomic status, factors relating to breast and bottle feeding, fluoride exposure, and parental smoking.⁴⁸ The presence of these factors is not necessarily predictive of decay. A child appears to be most at risk of caries if he/she acquires oral mutans streptococci at a young age. A high level of oral mutans streptococci may be partly compensated by other factors such as good oral hygiene and a non-cariogenic diet.⁴⁹

2⁺⁺

4.3 INFLUENCE OF PARENTAL ORAL HEALTH STATUS

The presence of maternal active decay, oral mutans streptococci, or reported high maternal sucrose consumption has not been proven to be predictive indicators of caries risk in children.⁵⁰ 2+

No other studies measuring parental oral health and relating it directly to that of children were identified. Parental deprivation is a risk indicator for caries development in their children.^{29,35} 3

4.4 CARIES RISK ASSESSMENT TOOL

There is evidence to show that caries in pre-school children can be predicted and that the development of a generalisable risk assessment tool (risk model) for pre-school children in Scotland is feasible.⁵¹ The Dundee Caries Risk Assessment Model (DCRM) was developed from data collected annually for over 1,500 children born in one calendar year in Dundee. Health visitors and a dentist collected longitudinal social, medical and dental data for four years. The two most significant risk indicators at age one year for the child having at least three carious teeth at age four years were living in council housing and the health visitor's opinion that the child was at risk of caries (sensitivity = 65%, specificity = 69%). Another study has also shown that healthcare workers' subjective assessment was an important factor in the assessment of caries risk in young children.⁵² 4 2+

This risk model would be appropriate for use by both dental and non-dental personnel and applicable in a primary care setting

D Specialist community public health nurses and child healthcare professionals could consider carrying out a caries risk assessment of children in their first year as part of the child's overall health assessment.

C A dental practice based caries risk assessment should be carried out on individual pre-school children and should include the following risk indicators:

- evidence of previous caries experience
- resident in a deprived area
- healthcare worker's opinion
- oral mutans streptococci counts (if accessible).

B Children whose families live in a deprived area should be considered as at increased risk of early childhood caries when developing preventive programmes.

A child considered by the healthcare professional to be at high caries risk should be referred to the appropriate health service provider.

5 Diet and nutrition

5.1 INTRODUCTION

This section examines the evidence base for the role of important constituents of foods, particularly foods containing sugar, and seeks evidence in areas of continuing uncertainty, such as the role of prolonged bottle or breastfeeding.

Much of the evidence on the role of diet in dental health is drawn from experimental studies, examining the chemical properties of foodstuffs in relation to extracted teeth, or animal studies. This has been exhaustively summarised in two narrative reviews.^{53,54}

5.2 MATERNAL DIET AND PREGNANCY

Low infant birth weight has been used as a proxy indicator of poor maternal diet during pregnancy but is a relatively poor indicator of maternal nutrition.⁵⁵

One systematic review was found which asked whether low birth weight children subsequently develop more caries than children with normal to high birth weight.³⁷ Although several of the studies reported a relationship between developmental defects of enamel and low birth weight, there was no evidence of a relationship between low birth weight and subsequent development of dental caries.

2+

Fluoride supplements in pregnant women have no beneficial effect on children's teeth.⁵⁶

1+

B Pregnant women should be advised that there is no benefit to the child of taking fluoride supplements during pregnancy.

5.3 MILK FEEDING AND CARIES

5.3.1 CARIOGENICITY OF HUMAN BREAST MILK AND SUBSTITUTES

Much of the research investigating the cariogenicity of milk feeds is laboratory based. These studies provide information on the relative acidogenic and cariogenic properties of human breast milk, cow's milk and infant formulae. It is difficult to extrapolate from these laboratory based studies to the complex oral environment.⁵⁴

Human breast milk (HBM) in vitro is not significantly acidogenic or cariogenic unless another carbohydrate source is available.⁵⁷ Unmodified cow's milk in vitro is non-acidogenic and caries develops in extracted teeth only after 14 weeks of direct exposure.⁵⁷ In contrast, most infant formulae are acidogenic and do support in vitro caries development.^{58,59} Soya infant formulae are theoretically more cariogenic, since they contain glucose syrup in place of lactose. One study found that one brand caused in vitro caries at a rate comparable to sucrose,⁵⁹ but another study investigating the effect of infant formula on plaque pH found no difference between soya and cow's milk based formulae.⁶⁰ In general, the soya infant formulae have a low buffering capacity compared to cow's milk formulae, which may be related to the absence of casein, a milk protein.⁵⁹

3

The Department of Health have recommended that unmodified cow's milk be given to children as a main drink only after the age of one year.⁶¹ The cariostatic nature of milk has been demonstrated in animal studies, and epidemiological studies suggest a negative or neutral relationship between cow's milk and dental caries.⁵⁴

3

5.3.2 DURATION AND TIMING OF FEEDING

One systematic review of epidemiological studies found inconsistent evidence of an association between breastfeeding beyond one year and the development of early childhood caries. The reviewers concluded that the apparent observed association between breastfeeding beyond one year is likely to be explained by other dietary factors not accounted for in the design of the studies.⁶² Current UK recommendations on breastfeeding are that infants should be exclusively breast fed for the first six months of age, after which infants should receive nutritionally adequate complementary foods while breastfeeding continues.⁶³ There is no recommended upper age beyond which breastfeeding should stop.

2+

4

Parents are currently advised against prolonged bottle use or putting a child to bed with a bottle, but the evidence on baby bottle use and caries risk is weak. A systematic review found that the duration of bottle use in itself is not significantly related to caries risk but that sweetened milk or juice given in a bottle increases the risk of caries.⁶⁴

2+

- C**
- **Members of the dental team should support and promote breastfeeding according to current recommendations.**
 - **Parents and carers should be advised that drinks containing free sugars, including natural fruit juices, should never be put in a feeding bottle.**

Parents and carers should be advised not to put children to bed with a bottle or feeder cup.

Parents and carers should be advised that soya infant formulae are potentially cariogenic and should be used only when medically indicated.

5.4 FREE SUGARS AND DENTAL CARIES

5.4.1 FREE SUGARS IN FOOD

The association between the consumption of free sugars and dental caries has been demonstrated over many years and many of the studies have been summarised in two narrative reviews.^{53,54} Three intervention studies that have tested this association were identified.

The first intervention study was conducted in an institution for adults with learning disabilities, some of whom were given extra sugar in their diet over a five year period.⁶⁵ This resulted in four to 10-fold increases in caries in those exposed to sticky sweets between meals and a two-fold increase in risk where sugar was added to meals. This trial was unethical by modern standards and would not be repeated.

2++

The second intervention study involved adult volunteers who substituted xylitol or fructose for sucrose in their diet for two years.⁶⁶ The control subjects had twice the rate of new cavitating caries compared to those on xylitol diets and an 11-fold greater risk of all caries.

2++

Both studies were conducted in adults who are at a lower risk of caries than pre-school children. Neither study was randomised, with systematic allocation in the first and personal choice in the second.

The third study compared otherwise similar Brazilian children in nurseries with and without guidelines restricting the consumption of sugars.⁶⁷ Children in the non-guideline nurseries consumed greater amounts of sugars at higher frequencies. After allowing for a range of relevant factors, including toothbrushing, home sugar intake and fluoride use, there was still a substantially increased risk of caries associated with attending a non-guideline nursery.

2++

A systematic review of observational studies found only a weak to moderate association between sugar consumption and dental caries and suggested that in the presence of fluoridation, sugars may no longer be such an important risk factor.⁶⁸ The studies included were mostly cross-sectional, relied on dietary report, and included no intervention studies. The results of this review should not overturn the weight of earlier trial evidence, and offer what may be false reassurance about the role of sugars in the development of caries.

2+

Children have an inherent liking for sweetened foods and drinks and the high energy needs of pre-school children mean that the extra palatability and energy density of sweet foods may be needed by some to ensure adequate growth.^{69,70} It is not realistic to expect parents to withhold sweet foods altogether, but avoiding sweet drinks and snacking between meals is both feasible and reasonable. The WHO review suggests that free sugars should be eaten on no more than four occasions per day.⁵⁴

B Parents and carers should be advised that foods and confectionery containing free sugars should be minimised, and if possible, restricted to meal times.

5.4.2 FREE SUGARS IN FLUIDS

The association between sweetened drinks and dental caries was examined in a large prospective study based in Iowa (though with a high rate of attrition, 67-85%). Apparent associations between sugared drink consumption at ages one to four and dental caries at age four to seven years were identified.⁷¹ This study, completed in an area with fluoridated water, found the highest risk associated with sweetened drinks given in the first year. The study also reported that total non-water drinks consumption in the first year, including milk, was the strongest risk factor, while total water consumption was highly protective, suggesting that some of the adverse effect of sugary drinks may be because they reduce consumption of (fluoridated) water.⁷²

2+

The finding of increased risk from intake of sweetened drinks in early life is supported by two studies that reported a high risk of caries or mutans streptococci colonisation associated with having sweetened bottle contents, but neither study appears to have controlled for other confounding factors, like social class or toothbrushing.^{45,73} One large UK study that did adjust for these variables found no increased risk associated with soft drinks and only a marginal risk associated with confectionery, but did not look specifically at bottle use or adjust for fluoride exposure.⁴⁹

3

Children with chronic diseases are often given liquid medicines sweetened with sucrose. One case control study found a fourfold increase in carious tooth surfaces in children taking sucrose based medicines compared to other children with chronic disease not so exposed.⁷⁴

2+

C Parents and carers should be advised that drinks containing free sugars, including natural fruit juices, should be avoided between meals. Water or milk may be given instead.

Sugar free formulations of medicines should be used if available and if not parents and carers should be advised to give doses with meals and never after toothbrushing at night.

5.5 OTHER FOODSTUFFS AND CARIES

No high quality studies were identified. Although the experimental literature suggests that starch may be weakly cariogenic, this is not supported by epidemiological studies. Similarly, whole fruit (as opposed to juice) is theoretically cariogenic but is not so in practice when eaten at normal consumption levels. There is some experimental evidence to suggest that cheese may be protective against caries.^{53,75} One trial found a substantial protective benefit from cheese taken regularly.⁷⁶

3
2+

No clear evidence was identified that foods not containing free sugars play a role in cariogenesis, or to suggest that any foods apart from cheese are protective. Apart from the sugar content, the composition of a child's food or the frequency with which it is eaten does not appear to be important in preventing dental caries.

C Parents and carers should be advised that cheese is a good high energy food for toddlers as it is non-cariogenic and may be actively protective against caries.

Parents and carers should be assured that sugar free snacks are unlikely to be cariogenic.

5.6 SUGAR SUBSTITUTES

Sugar substitutes used as sweeteners in the UK fall broadly into one of two categories: intense or bulk. There is little research on the role of intense sweeteners in dental caries, but due to their composition and minimal concentrations, they can probably be regarded as non-cariogenic.

Bulk sweeteners, most of which are polyols, such as xylitol, have been extensively researched. There is substantial experimental evidence in older children to suggest that xylitol may be cariostatic.⁷⁷⁻⁸⁰ Most field trials have involved chewing gums, which are not practically applicable to pre-school children. Trials of the use of chewable sweets, which might be more relevant, found substantial protective effects.^{77,79} 2+

A systematic review of trials incorporating both chewing gums and sweets concluded that there was still insufficient evidence that polyols actively prevented caries, since trials were unable to separate the effects of chewing any substance from the effect of the polyol itself.⁸¹ There is clear evidence that polyols are non-cariogenic, so they are a dentally safe substitute for sucrose in confectionery and other foods.⁶⁶ 2+

B Parents and carers should be advised that confectionery and beverages containing sugar substitutes are preferable to those containing sugars.

6 Toothbrushing with fluoride toothpaste

6.1 INTRODUCTION

This section discusses toothbrushing practice, examining effectiveness in preventing dental caries in pre-school children and suitability of each method for this age group. Use of fluoride mouthrinses is not recommended for children under six years of age due to the risk of fluoride ingestion.⁸²

6.2 USE OF FLUORIDE TOOTHPASTE

A Cochrane systematic review of 70 trials concluded that there was evidence for the efficacy of fluoride toothpastes in the prevention of dental caries in children and adolescents compared to placebo.⁸³ The magnitude of the effect was measured as a prevented fraction of 24%, that is 24% of dmfs can be prevented by brushing with fluoride toothpaste ($p < 0.001$).

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A Swedish systematic review of 54 trials also found evidence to support the caries-preventive effect of daily brushing with fluoride toothpaste in the young permanent dentition. This review comparing fluoride toothpaste with a placebo showed a prevented fraction of 24.9%.⁸⁴

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In both these reviews the majority of studies relate to the permanent dentition of young children and in the absence of studies on the primary dentition, this evidence has been extrapolated to the primary teeth of pre-school children.

A Children should have their teeth brushed with fluoride toothpaste.

6.3 FLUORIDE CONCENTRATION AND AMOUNT OF TOOTHPASTE

A Cochrane systematic review provided evidence of an association which failed to reach statistical significance ($p = 0.051$) between caries levels and fluoride concentration in toothpaste, with an 8% increase in prevented fraction per 1,000 parts per million fluoride (ppmF).⁸³

1⁺⁺

A Swedish review presented evidence of a dose-response relationship, highlighting the superior preventive effect of toothpastes containing 1,500 ppmF when compared with a standard concentration of 1,000 ppmF or 1,100 ppmF.⁸⁴ A significantly higher caries reduction was found after the daily use of toothpaste with 1,500 ppmF compared to the standard formulations, with a mean difference in prevented fraction of 9.7% (range 0 to 22%). A higher caries-preventive effect was also found with standard fluoride toothpaste compared to a concentration of 550 ppmF. The review provides limited evidence for the caries-preventive effect of toothpastes with fluoride concentrations lower than 550 ppmF.

1⁺

Evidence was also available from a systematic review of seven randomised controlled trials, five of which compared the effectiveness of 200-250 ppmF with 1,000 ppmF and two comparing 500 ppmF with 1,000 ppmF. Meta-analysis could not be carried out on two trials and results relate to a comparison of 200-250 ppmF with 1,000 ppmF. This review found a statistically significant greater mean caries increment in the 250 ppmF group than in the 1,000 ppmF group using both MFP (0.60, $p = 0.002$) and NaF (0.70, $p = 0.0005$) as the control toothpastes.⁸⁵

1⁺

There is evidence of a dose-response relationship between caries-preventive effect and the concentration of fluoride in toothpaste. One study demonstrated that 2,200 ppmF and 2,800 ppmF pastes delivered statistically significantly greater caries efficacy than 1,100 ppmF.⁸⁶ High-fluoride toothpastes, however, are not suitable for children under six years of age, due to the risk of fluorosis.⁸⁶ In the EU concentrations of 2,800 ppmF are only available on prescription and the highest fluoride concentration available in 'over-the-counter' toothpastes is 1,500 ppmF.

1⁺

A trial carried out among 12 year old Scottish children found that in the range of 1,000-2,500 ppmF every additional 500 ppm over and above 1,000 ppmF provides a cumulative 6% reduction in caries increment.⁸⁷

1⁺

Young children tend to swallow large amounts of toothpaste, giving rise to concerns of an increased risk of dental fluorosis related to ingesting fluoride-containing toothpaste.⁸⁸ This risk must be balanced against the caries protective effect of toothpastes containing higher concentrations of fluoride.^{87,89,90}

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1+

The level of fluoride intake (from all sources) beyond which 'unacceptable' dental fluorosis occurs has been estimated as 0.05-0.07 mgF/kg body weight/day.^{91,92} The mean contribution to total daily fluoride intake from toothpaste in children aged three to four years is estimated as 39-72% so that the amount of fluoride ingested from toothpaste should not exceed 0.022-0.036 mgF/kg body weight/day.⁹³ A study comparing fluoride ingested from toothpaste by 1.5 to 3.5 year old children in seven European countries showed that the mean amount ingested from toothpaste (in the range <400 ppmF-1500 ppmF) did not exceed this level in six of the seven sites.⁹⁴ The seventh site was excluded due to possible use of fluoride tablets confounding the results.

3

As the critical period for development of dental fluorosis is 22-25 months of age for the maxillary incisors, it has been suggested that care should be taken to limit the amount of toothpaste used, especially for children under three years of age, to a small smear or pea-sized amount, typically no more than 0.25 g (see Figure 4).⁹⁵ A study of pre-school children in New York found that the mean salivary fluoride concentration after using 0.25 g of toothpaste was approximately one-third the fluoride concentration after brushing with 1 g of paste ($p < 0.05$). Reducing the amount of fluoride toothpaste rather than the concentration of fluoride in toothpaste may be the most efficient way to maintain efficacy while decreasing the risk of fluorosis.⁹⁴ An observational study of the brushing habits of Dutch and Irish children aged between 1.5 and 3.5 years also recommended the use of small amounts of toothpaste (<0.5 g) due to the tendency for younger children to ingest toothpaste and older children to dispense more fluoride toothpaste on the brush.⁹⁶

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Figure 4: Smear and pea-sized amounts of toothpaste



Fluorosis levels were investigated in a follow-up study of high caries-risk children in the north west of England, who had received free toothpaste containing either 1,450 ppmF or 440 ppmF from the age of 12 months to five to six years.⁹⁰ This study assessed the prevalence and severity of dental fluorosis and other developmental defects of enamel (using wet and dry photographic images) when the children were aged eight to nine years.⁹⁷ All subjects identified with TF3 score (the level of fluorosis of aesthetic concern) were in the group using 1,450 ppmF toothpaste (three wet and four dry) and there were statistically significant differences between the three groups (1,450 ppm, 440 ppm and controls) for both wet ($p = 0.03$) and dry ($p < 0.01$) photographs. The follow-up pairwise comparison between the 1,450 ppmF group and the controls showed non-significant results ($p > 0.05$) with regard to fluorosis.

1+

Due to the slightly increased risk of fluorosis with 1,450 ppmF toothpaste, combined with the reduced effectiveness of concentrations of 550 ppmF and lower, the optimum balance between caries reduction and the risk of fluorosis can best be achieved using a concentration of 1,000 ppmF +/-10% toothpaste for pre-school children.

Parents of children receiving fluoride from other sources, ie fluoride tablets, should consult a dental professional before using toothpaste containing 1,000 ppmF.

- A** Toothpaste containing 1,000 ppmF +/-10% should be used by pre-school children.
- C** Pre-school children should use no more than a smear or small pea-sized amount of toothpaste.

6.4 FREQUENCY OF BRUSHING

A Cochrane review found the effect of fluoride toothpaste increases with higher frequency of use.⁸³ There were statistically significant associations between estimates of D(M)FS prevented fractions and frequency of use, with a 14% increase in prevented fraction with twice daily brushing as opposed to once daily.

1+

One cross-sectional study found a highly significant association between caries experience and claimed brushing frequency ($p < 0.001$), with a dmfs of 9.66 in the group brushing less than once per day compared to 7.36 in the group brushing more than once per day.⁹⁸ A survey found a statistically significant association ($p = 0.034$) between brushing frequency and lower caries in pre-school children, with a 13% likelihood of caries in those brushing less than once per day compared to 8% likelihood among children brushing more than once per day.⁴⁹ A study carried out on seven year old Flemish children also demonstrated higher caries experience if brushing frequency is less than once a day compared to brushing once or more per day ($p < 0.05$, OR = 1.24, CI 1.01 – 1.53).⁴²

3

Brushing more often than twice a day can lead to an increased risk of ingestion of toothpaste and potentially an increased risk of dental fluorosis.⁹⁹ The risk can be minimised if the quantity of fluoride toothpaste used is regulated, and with parental supervision of toothbrushing.

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6.4.1 SUPERVISED TOOTHBRUSHING

The majority of literature on supervised toothbrushing relates to school-based supervised programmes (see section 7). One Swedish cohort study carried out with parents and children found that one year old children who had help with toothbrushing had less caries at one, two and three years of age.¹⁰⁰

2+

Supervised brushing has been shown to be important in regulating the amount of toothpaste applied to the brush and the tendency for young children to swallow large amounts of toothpaste, thereby increasing the risk of fluorosis.¹⁰¹

4

- C** Children should have their teeth brushed, or be assisted with toothbrushing by an adult, at least twice a day, with a smear or pea-sized amount of fluoride toothpaste.

6.5 AGE AT COMMENCEMENT OF BRUSHING

The younger children are when they start toothbrushing the lower the proportion developing tooth decay.¹⁰² Overall, 12% of children who started brushing before the age of one year had some experience of decay, compared with 19% of those who started between the ages of one and two years, and 34% of those who did not start start toothbrushing until after the age of two years ($p < 0.01$).

3

One cross-sectional study, involving seven year old Flemish children, showed a significant odds ratio ($p < 0.001$) of 1.22 (CI 1.14 – 1.30) for an increased risk of caries when age at start of brushing increases by one year.⁴² It demonstrated a 46% likelihood of remaining caries free if brushing commences before three years of age as opposed to 36% if older than three years of age at commencement of brushing. The earlier toothbrushing commences (particularly before two years of age), the larger the decrease in caries risk.¹⁰³

3

There is a potential risk of fluorosis associated with early commencement of tooth brushing. A case control study found that the use of fluoride toothpaste before the age of 24 months was associated with an 11-fold increase in risk of enamel mottling.¹⁰⁴ The fluoride content of the toothpaste was not documented and the study was carried out in an area with water fluoridation, thereby increasing the risk of fluorosis. Fluorosis prevalence is higher in water-fluoridated areas than non-water-fluoridated areas and results from multiple exposures to fluoride.¹⁰⁵ This case control study, comparing the prevalence of enamel defects in children from water-fluoridated (1 ppm) and non-water-fluoridated parts of Cheshire, found that in fluoridated areas significantly more children whose parents claimed to be early brushers had enamel defects. There was no significant difference among children in the non-fluoridated area.

2+

C Toothbrushing should commence as soon as the primary teeth erupt.

6.6 TOOTHBRUSHING PRACTICE

6.6.1 POST-BRUSHING RINSING

A Swedish RCT of children aged four to seven years found that reducing the amount of rinsing water and refraining from eating for two hours after brushing decreased the amount and rate of fluoride removal from the mouth. Children in the test groups developed a mean of 1.14 new dfs during the three years of the study compared to 1.55 in the control groups ($p < 0.05$). This modified toothpaste technique resulted in an average of 26% fewer new approximal carious lesions, clinically and radiographically among test subjects, compared to children in the control groups.¹⁰⁶

1++

A Scottish trial carried out among older children (mean age 12.5 years) found that the caries increment in those who self reported using a beaker to rinse with water following brushing (6.84) was significantly higher than that in children who reported not using a beaker (5.84), ($p < 0.05$).⁹⁸

1-

Additional rinsing with water post-brushing reduces the caries-preventive effect of fluoride toothpaste and should be discouraged.

A Children should be encouraged to spit out excess toothpaste and not rinse with water post-brushing.

6.6.2 TIMING OF TOOTHBRUSHING

Brushing last thing at night before bedtime allows fluoride concentration levels to remain high during the night as salivary flow rates are lower during sleep.¹⁰¹ An observational study found that fluoride concentrations in saliva 12 hours after brushing last thing at night were comparable with those found one to four hours after brushing during the day.¹⁰⁷

4

Children's teeth should be brushed last thing at night, before bedtime and on at least one other occasion.

Eating directly after brushing should be avoided, to prevent fluoride from being washed out of the mouth prematurely.

6.6.3 USE OF POWERED VERSUS MANUAL TOOTHBRUSHES

One systematic review and one RCT were identified, both of which examined plaque removal and reduction in gingivitis.^{108,109} No clinically meaningful differences in plaque removal were found between powered and manual brushes. No studies were identified indicating that plaque removal alone, without the application of fluoride, prevents caries.

1⁺⁺

A Children’s teeth can be brushed with either manual or powered toothbrushes as an effective means of administering fluoride.

A toothbrush should be the right size and design to allow the user to reach all tooth surfaces and gum margins easily and comfortably.¹¹⁰

4

Parents and carers should use a toothbrush with a small head for children.

6.7 USE OF DENTAL FLOSS

Flossing can remove plaque from approximal tooth surfaces and may have a role in reducing caries. A combination of brushing with fluoride toothpaste and flossing is more efficient, especially if regular flossing is carried out by an adult.¹¹¹ Flossing on its own cannot be recommended for the prevention of dental caries in pre-school children without the associated application of fluoride to the dentition.

4

7 Community based prevention

7.1 INTRODUCTION

In the context of this guideline the terms “health education” and “health promotion” are defined as:

- **Health education** is a process that results in individuals or groups having increased knowledge related to health.
- **Health promotion** supports individuals in translating their health knowledge into positive behaviours and lifestyles. Health promotion activities should be directed at a wide variety of areas likely to impact on health, eg social, economic and structural environments as well as the policies of public and local institutions. The rationale is to increase the community’s day-to-day capacity and ability to follow a healthy lifestyle.

The evidence to support the promotion of oral health within the community is limited, and evidence from wider health promotion interventions, with general applicability, has also been considered.

The oral health papers explore specific interventions and settings and do not fully address all areas of caries prevention outwith the dental practice setting, nor do they explicitly target pre-school children. The majority of the studies identified included multiple interventions in relation to several aspects of prevention. The role of dental and non-dental team members could not be separated within the studies.

7.2 DENTAL HEALTH EDUCATION

A review of public health education interventions found that studies aiming to increase knowledge were successful, but the effect of information acquisition on behaviour was uncertain. It concluded that health education interventions alone are insufficient to change behaviour but can be effective when combined with environmental or legislative changes.¹¹²

4

Dental health education on a one to one basis to parents and carers has not been shown to be consistently effective in changing behaviour.^{113,114}

2++

No evidence was identified that demonstrated changes in knowledge were causally related to actual health outcomes.

One to one dietary advice in isolation has not been found to be effective in preventing caries. The outcomes from most community based dental health education interventions aiming to reduce dietary sugar are inconclusive.^{113,114}

2++

No evidence was identified about the effectiveness of unsupported advice advocating the use of fluoride toothpaste or changes in toothbrushing behaviour, outwith structured toothbrushing programmes.

B Dental or dietary health education in isolation should not be undertaken as a community based prevention approach.

7.3 HEALTH PROMOTION

Health promotion interventions based on theoretical frameworks incorporating skills training and strategies to modify beliefs regarding risks, and which include multisessional programmes, are effective.¹¹²

4

Health promotion programmes have been successful in achieving positive oral health outcomes in older age groups. These interventions have included the tailoring of information to meet the needs of specific groups, active involvement by participants, direct contact from services and active learning techniques in addition to dental health education.¹¹⁵

2++

Multiple intervention health promotion programmes incorporating dental health education with other interventions are effective at reducing caries in young children and promoting other supportive health behaviours. The additional interventions within these programmes include the tailoring of information to individual parents, home based delivery of programme interventions, multiple sessions and the inclusion of oral health promotion as part of a wider child health programme.¹¹⁶⁻¹¹⁸ 3

The timing of oral health promotion programmes also appears to be important. A number of studies with effective outcomes were carried out with children under the age of three years.^{116,118} Oral health promotion programmes for parents initiated at the prenatal stage and continued postnatally were more effective in reducing childhood caries, plaque levels and maternal and child salivary mutans streptococci.^{118,119} 3

C The oral health of young children should be promoted through multiple interventions and multisessional health promotion programmes for parents.

- D**
- Oral health promotion programmes to reduce the risk of early childhood caries should be available for parents during pregnancy and continued postnatally.
 - Oral health promotion programmes for young children should be initiated before the age of three years.

Evidence suggests that environmental and/or policy changes, such as changes to school meals, linked to education seem to have the greatest impact in improving school children’s dietary intake.¹¹² There is insufficient evidence of interventions specifically relating to the improvement of post-weaning and pre-school diets to draw any conclusions. 4

One cohort study suggests that the use of dietary guidelines (ie policies on availability of foods and snacks) can lead to changes in observed sugar consumption in the nursery and in reported intake at home.⁶⁷ The impact on oral health status was beneficial, with reduced caries increments associated with reduced intake and frequency of sugar in the nursery setting. 2++

D Oral health promotion programmes should address environmental, public and social policy changes in order to support behaviour change.

Evidence is lacking for the effectiveness of the role of primary care physician-led interventions such as oral screening, referral and counselling in preventing caries in pre-school children.¹⁸

7.4 COMMUNICATING ORAL HEALTH MESSAGES

A cross-sectional study explored the integrated delivery of oral health messages by multidisciplinary health professionals and lay workers as part of a community based oral health promotion programme. Communities were offered support to apply evidence based oral health messages in order to modify lifestyles. The programme demonstrated significant improvements in the dental health of pre-school populations in two areas of deprivation.¹²⁰ 2+

C Professionals should ensure oral health messages are relevant and applicable to communities and lifestyles.

Professional groups, such as nurses and midwives, are as effective as other clinical colleagues in delivering health promotion interventions.¹¹² 4

Oral health education can be delivered effectively by teachers, carers and community workers and can be successfully incorporated into established programmes and practices in other sectors.¹¹⁵ 2++

Although a lack of oral health knowledge is a factor for other professionals when addressing oral health, this can be addressed through the provision of training.^{121,122} Different professional groups were equally effective at delivering consistent messages following a programme of training as part of a home based child health programme.¹¹⁸ 3

A cross sectional study identified that inconsistent preventive advice was being offered by dentists and health visitors to families with young children. An observational study reported that inconsistent messages were apparent between dental practitioners relating to the appropriate care of young children.¹²³ There is a need for improved quality and coordination of oral health advice across different professional groups.¹²⁴

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C Teachers, community workers and lay or peer educators can be effective in delivering health promotion interventions and their role should be considered in the development of oral health promotion programmes.

D Non-dental health professionals and lay oral health workers should be provided with adequate educational or training interventions prior to their participation in oral health promotion programmes.

Multidisciplinary approaches across a range of settings should be taken in the delivery of oral health promotion programmes.

The use of consistent oral health messages should be promoted to support multidisciplinary approaches within oral health promotion programmes.

7.5 HEALTH PROMOTION PROGRAMMES INCLUDING FLUORIDE

Interventions advocating the use of fluoride are consistently found to be effective, with cumulative benefits.^{90,116,117,125}

1++

A clinically based prevention strategy (including fluoride supplementation, and three monthly use of acid-phosphate-fluoride applications and fissure sealing) was effective in improving oral health and reducing caries.¹²⁶ Parental compliance dropped when the clinically based prevention strategy was transferred to a community based setting.¹²⁷

2+

In an RCT demonstrating the effectiveness of postal distribution to supply free toothpaste to children in deprived areas oral health outcomes were related to the concentration of fluoride in the toothpaste. A reduction in dmft by 16% was found where toothpaste had a fluoride content of 1,450 ppm ($p < 0.05$) compared to a control group receiving no supply.⁹⁰ Although this study used a fluoride content of 1,450 ppmF, the recommended level for pre-school children is 1,000 ppmF (see section 6.3).

1+

A home visit based health promotion intervention tailored to individual mothers at the time of eruption of their child's first teeth was effective in promoting positive oral health behaviours, including toothbrushing with fluoride toothpaste.¹¹⁶

2+

A Community or home based oral health promotion interventions should use fluoride containing agents such as fluoride toothpaste.

7.6 TOOTHBRUSHING PROGRAMMES SET IN COMMUNITY OR SCHOOL VENUES

Two systematic reviews provide evidence of greater caries reductions with supervised brushing compared to non-supervised brushing. The Swedish review demonstrated a prevented fraction of 23.3% with supervised brushing.⁸⁴ The Cochrane review found that unsupervised brushing resulted in a 10% lower prevented fraction than supervised brushing.⁸³

1++

Supervised brushing with fluoride toothpaste $> 1,000$ ppmF increases the number of caries-free children, even in low caries groups (see section 6.3).¹²⁸

2+

A Scottish RCT found that five year old children who brushed daily under supervision with fluoride toothpaste had significantly fewer carious lesions on their newly erupted first permanent molars at the end of the supervised brushing study (32% fewer d_1 lesions and 56% fewer d_3 lesions than children in the non-intervention group).¹²⁹

1+

Working with parents is important to develop a supportive environment to encourage behaviour change in young children.¹¹⁵ The effectiveness of nursery toothbrushing programmes was only sustained during a holiday period when combined with oral health education targeted to parents. 2⁺⁺

Community based toothbrushing programmes should:

- A** ■ include fluoride toothpaste with a concentration of 1,000 ppmF
- B** ■ be undertaken in community based settings such as nurseries
- B** ■ be undertaken with parents to create a supportive environment for oral health behaviour.

7.7 FLUORIDE TABLETS, SALT AND MILK

A systematic review found insufficient evidence regarding the effectiveness of fluoride tablets, fluoride in salt and fluoride in milk with regard to caries prevention.¹³⁰ 2⁺⁺

A narrative review considers fluoride supplements to be inappropriate as a public health measure and notes poor compliance with supplement use. Where fluoride toothpaste is used the additional benefits from supplements are marginal.¹³¹ It may be appropriate for dental practitioners to prescribe supplements on an individual basis to pre-school children after a caries risk assessment.¹³² 4

One UK based case control study with methodological flaws investigated the use of fluoridated school milk over a four year period with children aged three to five years at commencement. It found no reduction in caries in the primary dentition and minimal impact on the permanent dentition.¹³³ Another case control study suggests that the consumption of fluoridated milk by pre-school children in China was effective in preventing caries in primary teeth.¹³⁴ 2⁻
2⁺

D Fluoride supplements are not recommended as a public health measure.

D Fluoride supplements should only be prescribed by dental practitioners on an individual patient basis.

7.8 WATER FLUORIDATION

Water fluoridation is associated with an increase in the proportion of children without caries.¹³⁵ In 2000, a systematic review found that the number needed to treat (NNT) for one extra child to be caries free is six. This figure encompasses varying caries prevalence rates throughout the world, and the impact on the Scottish population, which has relatively high caries levels, may be greater. A beneficial effect in terms of mean changes in decayed, missing and filled teeth occurred in the fluoridated compared with the non-fluoridated areas. Water fluoridation increases the risk of fluorosis. At water fluoride concentrations of 0.1 and 1 ppmF, it was estimated that 6.3% (95% CI: 3.2-12.4%) compared with 12.5% (95% CI: 7.0-21.5%), respectively, of exposed people would have fluorosis considered aesthetically concerning.¹³⁶ This review included studies in countries with hotter climates than the UK, and a subsequent review reported that these percentages would probably be lower in the UK, where the cooler climate would result in a reduced water intake.¹³⁷ There was no clear evidence of other potential adverse effects. The guideline development group considered this evidence and agreed that a robust evaluation of the benefits of water fluoridation, as well as the potential risks of fluorosis, in the current environment in Scotland, should be a health priority. The group agreed that a community water fluoridation scheme should be introduced in one region, with full evaluation of the scheme to measure all relevant clinical outcomes. 2⁺⁺

7.9 TARGETED PREVENTION

There are two approaches to community based prevention; population based approaches, eg information provision to all households, and targeting specific groups within a population, eg pre-school children.

7.9.1 POPULATION BASED PREVENTION

A school based oral health education programme (including the distribution of toothbrushes) demonstrated a sustained improvement in plaque scores for children in non-deprived schools compared with no improvement in children in deprived areas. Children from the deprived areas did not benefit from the programme and existing inequalities in health were increased.¹¹⁵ 2⁺⁺

Water fluoridation is a population based approach that will reduce the total number of caries throughout the population¹³⁷ (see section 7.8). 2⁺⁺

There is limited and inconsistent evidence that mass media campaigns targeting the population prevent risk taking behaviours or are effective at promoting either knowledge, behaviour change or health related outcomes.¹¹⁵ 2⁺⁺

7.9.2 TARGETING SPECIFIC GROUPS

Targeting specific groups was more effective than community wide interventions to improve diet in children.¹¹² The findings of a systematic review indicate that strategies targeting high-risk groups within a whole population might help reduce inequalities in oral health.¹¹⁵ 4
2⁺⁺

Posting fluoride toothpaste (1450 ppmF) to a targeted 'at risk' population of children was found to be effective in reducing caries prevalence.⁹⁰ 1⁺

A targeted community development programme in a socioeconomically disadvantaged area aimed to deliver consistent messages, improve diet, provide free access to fluoride from toothpaste (1,000 ppmF) and support nursery toothbrushing schemes. The multiple intervention programme was associated with significant improvements in the dental health of pre-school children over a four year period.¹²⁰ 2⁺

B The impact on inequalities in oral health should be considered when planning population based prevention strategies.

B Caries prevention measures should target 'at-risk' populations and individuals to reduce oral health inequalities.

8 Practice based prevention

8.1 INTRODUCTION

The visit of a pre-school child and their parent or carer to the dental practice is an ideal opportunity for the dental team to provide information, encouragement and preventive treatments all aimed at improving the child's oral health. The dental team should provide oral health advice that is consistent with that delivered by other healthcare workers and educators. The preventive advice and treatments provided should be of proven efficacy, and be targeted at children assessed as being at increased risk of caries (see section 4.2). Advice on fluoride supplementation is discussed in section 7.7.

8.2 HEALTH EDUCATION BY THE DENTAL TEAM

The role of the dental health team in the prevention of oral caries is described within three systematic reviews.¹¹³⁻¹¹⁵ Dental health education (information giving) has not been shown to be consistently effective in changing behaviour.^{113,114} Studies within these reviews suggest that chairside interventions are effective in improving oral hygiene and reducing caries when combining dental health education, oral hygiene instruction and fluoride applications, including toothpaste. The wider dental team (hygienists and auxiliary personnel) were found to be effective in modifying individuals' oral hygiene behaviours in the short term through oral hygiene instruction or dental health education.¹¹⁵

2⁺⁺

The role of the dental practice in providing an effective prevention strategy, incorporating fluoride therapy, in the form of gels and drops/tablets, fissure sealants and tailored dental health education by a hygienist was undertaken in a study in a single health centre. When rolled out into the community setting across eight clinics, the effectiveness of the intervention was reduced.¹²⁶ A lack of sustained interdisciplinary referral from health professions other than dentistry and dwindling patient attendance and compliance over time were associated with the reduced benefits of the intervention.¹²⁷

2⁺⁺

A systematic review recognised the role of the parent in creating supportive home environments for behaviour change in young children.¹¹⁵ The involvement of parents in an oral health education programme to support home toothbrushing for young children sustained the improvements in oral hygiene achieved by a nursery based toothbrushing programme throughout a holiday period.

2⁺⁺

B The dental health team should deliver caries prevention strategies in conjunction with physical prevention techniques such as the use of fluoride.

B Parents and their pre-school children should receive oral health education from their dental team. This should include oral hygiene instruction, the appropriate use of fluoride toothpaste and the provision of fluoride agents such as toothpaste.

Dental practice based community prevention strategies should be designed to meet the needs of the community, and multidisciplinary involvement should be secured.

Parents should be encouraged to take their children for regular dental care as soon as the first teeth erupt.

8.3 TOPICAL FLUORIDE VARNISH

Topical fluoride varnish is effective in the prevention of decay in permanent teeth.^{130,138-141} A Cochrane review reported a dmfs caries prevented fraction of 33%.¹³⁹ The number needed to treat to prevent one carious surface in the primary dentition ranged from 3.7 children for areas with the relatively low caries increment of 0.82 dfs per year to an NNT of 1.6 children in areas with dfs increment of 1.9 dfs per year. Care must be taken to follow the manufacturer's guidance regarding use as these products have high concentrations of fluoride.

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B

Topical fluoride varnish should be applied to the dentition at least twice yearly for pre-school children assessed as being at increased risk of dental caries.

8.4 OTHER FLUORIDE BASED TREATMENTS

8.4.1 SLOW RELEASE FLUORIDE BEADS

There is insufficient evidence on which to base a recommendation at present.

8.4.2 SILVER DIAMINE FLUORIDE

An RCT from China on the use of silver diamine fluoride in pre-school children with early childhood caries showed that twice as many lesions arrested (2.8 surfaces per child) as with Duraphat varnish (1.5 surfaces per child).¹⁴² The solution used was extremely concentrated and concerns have been raised about its toxicity.¹⁴³ There is insufficient evidence regarding the safety of silver diamine fluoride to make a recommendation on its use with pre-school children.

1+

8.5 ANTIMICROBIALS

Four systematic reviews were identified reporting on the use of chlorhexidene on permanent dentitions. The studies used small sample sizes, involved concomitant use of fluoride, or were poorly designed.^{130,138,140,144} Further research is needed before a recommendation can be made.

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8.6 FISSURE SEALANTS

Primary molars can be fissure sealed satisfactorily. An RCT investigating the effect of different etch times on sealant retention in second primary molars and first permanent molars found that complete sealant retention rates for primary molars at one year exceeded that for first permanent molars (65% compared to 44%) with no difference found between a 30 seconds etch and a 60 seconds etch.¹⁴⁵ A systematic review reported that the evidence regarding the caries-preventive effect of fissure sealants in primary molars was incomplete.¹⁴⁶

1++

9 Practice based management

9.1 MANAGEMENT OF THE ACTIVE CARIOUS LESION IN PRIMARY TEETH

The provision of restorative care for primary teeth is problematic. Issues include the child's capacity to accept dental treatment, their dentist's willingness and ability to provide it, parental motivation and expectations, overwhelming levels of disease in some children, access to care and funding. Currently accepted best practice is that when active dental caries extends into dentine, the infected dentine should be removed and a restoration placed.¹⁴⁷

4

Two retrospective audits of primary care dental practice records have questioned the restorative approach.^{148,149} The audits show that the majority (around 80%) of carious primary teeth exfoliate naturally, without the child attending the dental practice in pain. Drawing firm conclusions from audit data is problematic.

3

In the absence of evidence supporting a non-restorative, prevention-only approach, it would seem prudent to continue to follow current guidelines.¹⁴⁷

D Primary teeth with caries progressing into dentine should be actively managed with a preventive, or a preventive and restorative approach as appropriate to a child's ability to cooperate.

Restorative treatment should always be provided in conjunction with a course of preventive treatment.

Appropriate use of radiography is an essential component of an effective caries management programme in children and is discussed in section 2.4.2.

9.2 CAVITY PREPARATION TECHNIQUES

9.2.1 EXTENT OF CARIES REMOVAL

If complete caries removal from a primary tooth is not possible there is evidence that the caries will either arrest, or its progress be significantly slowed down, following effective sealing in by a restoration.¹⁵⁰⁻¹⁵³

2+
1+

B If complete caries removal from a vital primary molar is not possible, an indirect pulp capping technique should be considered.

A calcium hydroxide containing lining material, followed by an adhesive restoration or a preformed metal crown, should be used.

9.2.2 IATROGENIC DAMAGE DURING CAVITY PREPARATION

The approximal surface of the adjacent tooth is frequently damaged when preparing a Class II cavity.^{154,155} This damage is associated with a significantly increased risk of subsequent caries development (10% of undamaged surfaces compared to 35% of damaged surfaces in primary molars going on to become carious in one study).¹⁵⁴

2++

B When preparing a Class II cavity, care must be taken to avoid iatrogenic damage to adjacent proximal tooth surfaces.

9.2.3 THE ATRAUMATIC RESTORATIVE TECHNIQUE

The Atraumatic Restorative Technique (ART) approach uses very sharp hand instruments for cavity preparation, followed by cavity restoration with glass-ionomer cements. No rotary instruments or local anaesthesia are used.¹⁵⁶ ART was introduced for use in developing countries where access to electricity might not always be available.

Studies in Indonesia and Pakistan suggest that children may perceive the ART approach to cavity preparation as being less stressful than conventional cavity preparation and less painful. The studies included only single surface lesions and were conducted in countries where it is possible that a reduced exposure to fluoride could result in earlier cavitation of carious lesions compared with the UK, making the cavities easier to manage with an ART approach.¹⁵⁷⁻¹⁵⁹

1+

The ART approach traditionally uses glass-ionomer as the restorative material of choice. This material has been shown to have an unsatisfactory performance in Class II cavities in primary teeth, and alternative materials should be considered for restoring these cavities.^{156,160}

2+

B Use of the ART approach for cavity preparation in carious primary teeth should be considered as an alternative, where appropriate, to conventional cavity preparation techniques.

9.2.4 PULPOTOMY

The pulpotomy technique allows the retention of primary molar teeth with pulpal involvement, although with no evidence for the superiority of one type of pulpotomy technique.¹⁶¹ As there are concerns regarding the safety of formaldehyde¹⁶² the use of alternative materials to formocresol for pulpotomies in primary teeth should be considered. There is some evidence that immediate restoration of a tooth following pulpotomy with a preformed metal crown can improve the success rate.¹⁵¹

1++
4
2+

Formocresol should be replaced by alternative materials for pulpotomy procedures in primary teeth.

9.2.5 DENTAL LASERS AND CHEMOMECHANICAL TECHNIQUES

Cavity preparation using dental laser and chemomechanical techniques is problematic with regard to both speed of use and completeness of caries removal.^{163,164}

1+

Both techniques require further development before a recommendation can be made.

9.3 MATERIALS FOR CAVITY RESTORATION

A systematic review, twelve RCTs and five observational studies on choice of restorative material for cavity restoration in the primary dentition were identified.^{10,160,165-180} Most compared the performance of materials using a split-mouth study design. The reported success rate of the restorations ranged between 67%-95% after two years and 50%-94% after three years depending on the material used. The studies may not be generalisable to general dental practice, as the majority were either carried out in private practice or in a secondary care setting.

1+
2+

Glass-ionomer material performed satisfactorily in Class I cavities but was found to have a significantly poorer durability when used for Class II cavities. One RCT involving over 1,000 restorations followed up for three years reported that the use of glass-ionomer instead of amalgam would require 200 extra re-treatments per 1,000 restorations placed.¹⁷¹ While 21% of surfaces adjacent to the amalgam restorations required subsequent restoration, this was only necessary for 12% of surfaces adjacent to the glass-ionomer restorations. Many operators use rotary instruments when preparing cavities for amalgam and this could have been a confounding factor. One study comparing a resin modified glass-ionomer with amalgam for Class II cavities in primary molars found both to have survival rates of 73% and 71% after three years, although this study had a very high drop-out rate of over 50%.¹⁷⁸

1+

A

- Amalgam, composite, resin-modified glass-ionomers, compomer or pre-formed metal crowns should be used as restorative materials for Class II cavities in primary molars.
- Conventional glass-ionomer should be avoided, where possible, for Class II cavity restoration.

9.4 NON-CONVENTIONAL CARIES MANAGEMENT TECHNIQUES

In view of the accepted difficulties of providing restorative treatment for dental caries in young children, there has been interest in strategies which avoid the use of rotary instruments and local anaesthesia. These include techniques such as the use of ozone, stannous and silver fluoride, silver nitrate, the Hall technique (sealing in caries under a pre-formed metal crown) and making cavities self cleansing. Insufficient evidence was found to make any recommendation regarding these techniques.

Black copper cement has been suggested as a restorative material for primary teeth, but a single RCT found it to have a significantly higher failure rate than the control restoration.¹⁵³ | 1+

B **Copper phosphate cement** (*black copper cement*) **should not be used as a restorative material.**

10 Implementation and audit

10.1 LOCAL IMPLEMENTATION

Implementation of national clinical guidelines is the responsibility of local NHS organisations and is an essential part of clinical governance. It is acknowledged that not every guideline can be implemented immediately on publication, but mechanisms should be in place to ensure that the care provided is reviewed against the guideline recommendations and the reasons for any differences assessed and, where appropriate, addressed.

The guideline complements the Scottish Executive's Action Plan for Improving Oral Health and Modernising Dental Services.¹⁸¹ The guideline outlines the need for wider involvement than health and dental professionals and discussions around caries prevention and dental care for pre-school children should involve a range of clinical disciplines, lay representatives, parents and nursery staff, with an emphasis on reducing inequalities in health. Local arrangements may then be made to implement the national guideline in community settings, clinics, practices and nurseries, and to monitor compliance. This may be done by a variety of means including patient-specific reminders, continuing education and training, and clinical audit.

10.2 KEY POINTS FOR AUDIT

10.2.1 DIAGNOSIS AND CARIES RISK ASSESSMENT

- What proportion of pre-school children have had contacts with the following types of professionals as part of oral health prevention and care: a) health visitors b) nursery-based staff c) community dental services staff d) general dental practitioners e) national dental inspection programme teams f) secondary care dental services staff?
- How many children have had a caries risk assessment carried out by a health visitor?
- How are general dental practitioners using caries risk assessments, and what risk criteria are they using?
- What proportion of children have had clinical examinations at the early enamel lesion (d1) level?
- How many children in this age group have had bitewing radiographs taken, and had radiographic recall intervals linked to a caries risk assessment?

10.2.2 PREVENTION

- What are children in this age group being given to drink by their parents/carers and how frequently are they being given it?
- What is the frequency of toothbrushing, and how much toothpaste is being used?
- What level of supervision is given to pre-school children when brushing, both at home, and in nursery-based programmes?
- What proportion of children at increased risk of dental caries are receiving twice-yearly applications of fluoride varnish, applied by GDPs, or the community dental service?
- What strategies are being used by GDPs in primary care to encourage regular brushing with an appropriate fluoridated toothpaste for their pre-school patients?

10.2.3 MANAGEMENT OF DENTAL CARIES

- What restorative materials are currently being used by GDPs for managing Class I and Class II carious lesions in pre-school children?
- What criteria are GDPs using to decide between adopting a restorative plus prevention, or a prevention-only approach, for managing carious teeth in pre-school children?
- What are the outcomes for a restorative plus prevention, or a prevention-only approach when managing carious primary teeth?
- What materials are being used in primary care for pulpotomies?

10.3 RECOMMENDATIONS FOR RESEARCH

During the identification and critical appraisal of evidence for this guideline, it became apparent that there is limited evidence from high quality, rigorous and methodologically sound research, and that the evidence which is available is often poor and incomplete.

Recommended areas for further research include:

- evaluating the benefits, and potential risks of fluorosis, of a community based water fluoridation scheme in the current environment in Scotland
- determining the relationship between oral health and health inequalities
- exploring how dental services should be provided in areas of deprivation to minimise inequalities
- evaluating community based prevention programmes, including the involvement of health visitors
- ascertaining the most effective combination of preventive, or preventive and restorative, interventions for different caries-risk groups, with different levels of deprivation, in different settings
- examining the relationship between age and caries experience in the pre-school child
- describing the caries experience of pre-school children with special needs
- completing RCTs to investigate apparent caries-reducing effect of sugar substituted sweets
- investigating the effect of breast and bottle feeding on the development of early childhood caries in studies that control for other dietary factors
- identifying effective interventions to improve the diet at weaning and pre-school age
- examining the effectiveness of structured nursery toothbrushing programmes
- determining the optimum age at which to commence brushing children's teeth
- exploring the effect of one to one dental health education on health outcomes
- evaluating the effectiveness of dental health education programmes promoting the use of fluoride outwith a structured programme
- examining the effects of maternal use of xylitol in preventing caries in young children
- identifying specific barriers to the implementation of oral health strategies, and how to overcome them
- assessing the effectiveness of preventive advice delivered by the dental team in the dental practice environment
- determining the effectiveness of fluoride and chlorhexidine varnishes, and fissure sealing in the primary dentition
- conducting RCTs in primary care to investigate the relative efficacy of conventional restorative management of carious primary teeth including the role of general anaesthetic compared with alternative techniques, and with a prevention-only approach
- establishing the effect of remuneration on quality of dental care and availability of dental practitioners.

10.4 RESOURCE IMPLICATIONS

It is unlikely that any individual recommendation is associated with significant resource implications for NHS Scotland. The Action Plan for Improving Oral Health and Modernising Dental Services in Scotland has been published and is being implemented incrementally. This should change not only the way young patients receive care, but also the type of care they receive. As implementation is rolled out, continued economic and health services analyses should be undertaken to ensure that the potential long-term advantages from effective prevention of dental caries in pre-school children are being delivered.

11 Information for parents and carers

Parents and carers need information to help them understand dental care and treatment options. The following are answers to frequently asked questions which could be used in discussion with parents and carers or as the basis of an information leaflet.

11.1 FREQUENTLY ASKED QUESTIONS

Why does my child have baby teeth?

The mouth of a young (pre-school) child is just too small to be able to fit in all their adult teeth, so they have a set of smaller, baby teeth to use while they grow. These teeth start to appear at 6 months of age, and are all in by 2½ years of age. The baby teeth start to be replaced by adult teeth around 6 years of age, with the last ones (right at the back) being lost around 12 years of age.

If baby teeth fall out anyway, why is it important to keep them healthy?

Two main reasons. Firstly, and most importantly, a decayed baby tooth can cause a child severe pain, and can lead to a serious mouth infection. Often, the only way of managing a young child with toothache is to take out teeth under a general anaesthetic.

Secondly, baby teeth keep the space for adult teeth to come into. If baby teeth are taken out early, it increases the chance that the child will have crowded adult teeth, and will need to have some adult teeth taken out and orthodontic (tooth straightening) treatment with a brace.

Why can baby teeth cause my child pain and abscesses if they become decayed?

This is because all baby teeth have a hollow space inside them, which is filled with the tooth's nerve. The nerve is close to the surface of the tooth, and if decay reaches it, the nerve will become inflamed. This can be very painful. Left untreated, the nerve will die and become infected, and the infection will spread through the roots of the tooth and into the child's jaw.



A baby back molar tooth

Isn't it easy just to take a baby tooth out if it causes my child pain?

Unfortunately, it isn't easy to take out a baby tooth from a young child. As you can see from the photograph, the roots of baby teeth can be very long, and reach down well inside the child's jaw bone.

To take the tooth out, the dentist will have to give the child an injection in the gum on both sides of the tooth. The dentist will then have to push very hard with forceps on the tooth to loosen it in the jaw bone before taking it out. Many young children find the pushing and noises to be quite upsetting.

Do decayed baby teeth always have to be taken out?

No, not at all. If you take your child to the dentist regularly for check-up appointments, then the baby teeth can be treated before they cause problems. For the treatment to be successful the patient/carer of the child must look after the child's teeth for them.

When should my child be taken to the dentist?

As early as possible, and certainly by the time their first teeth start to appear.

What can the parent/carer of a child do to stop decay in the child's baby teeth?

Help your child to brush their teeth twice a day, with a smear or pea-sized amount of toothpaste (1,000ppm fluoride) depending on their age; spitting out, not rinsing after brushing. Allow them to have only water or milk to drink between meals, restrict sugary snacks to mealtimes and take your child to the dentist regularly.

11.2 SOURCES OF FURTHER INFORMATION

British Dental Association

64 Wimpole Street
London W1G 8YS
Tel: 020 7935 0875 • Fax: 020 7487 5232
Email: enquiries@bda.org • www.bda.org

British Dental Association Scotland

Forsyth House, Lomond Court
Castle Business Park, Stirling FK9 4TU
Tel: 01786 433810 • Fax: 01786 431810
www.bda-dentistry.org.uk

British Dental Health Foundation

Smile House, 2 East Union Street
Rugby, Warwickshire CV22 6AJ
Tel: 0870 770 4000 • Fax: 0870 770 4010
Dental Helpline: 0845 063 1188 (local call rate in the UK)
Email: mail@dentalhealth.org.uk • www.dentalhealth.org.uk

British Fluoridation Society

Ward 4, Booth Hall Children's Hospital
Charlestown Road, Manchester M9 7AA
Tel/Fax: 0161 220 5223
Email: bfs@bfsweb.org • www.bfsweb.org

British Nutrition Foundation

High Holborn House
52-54 High Holborn, London WC1V 6RQ
Tel: 020 7404 6504 • Fax: 020 7404 6747
Email: postbox@nutrition.org.uk • www.nutrition.org.uk

British Society of Paediatric Dentistry

www.bspd.co.uk

National Fluoride Information Centre Website

Coupland III Building, University of Manchester
Oxford Road, Manchester M13 9PL
Tel: 0161 275 8948
Email: info@fluorideinformation.com • www.fluorideinformation.com

NHS Health Scotland

Woodburn House, Canaan Lane
Edinburgh, EH10 4SG
Tel: 0131 536 5503
www.hebs.com

NHS Scotland web portal

www.scottishdental.org

Scottish Health on the Web

www.show.scot.nhs.uk/breastfeed/

12 Development of the guideline

12.1 INTRODUCTION

SIGN is a collaborative network of clinicians, other healthcare professionals and patient organisations and is part of NHS Quality Improvement Scotland. SIGN guidelines are developed by multidisciplinary groups using a standard methodology based on a systematic review of the evidence. Further details about SIGN and the guideline development methodology are contained in *SIGN 50: A guideline developer's handbook*, available at www.sign.ac.uk

12.2 THE GUIDELINE DEVELOPMENT GROUP

Dr Dafydd Evans (Chair)	<i>Senior Lecturer and Consultant in Paediatric Dentistry, Dundee Dental Hospital and School</i>
Dr Frazer Andrews	<i>General Dental Practitioner, Biggar</i>
Ms Anna Baxendale	<i>Health Promotion Manager, Greater Glasgow NHS Board</i>
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Dr Chris Deery	<i>Consultant in Paediatric Dentistry, Edinburgh Dental Institute</i>
Dr John Glen	<i>General Dental Practitioner, Cowdenbeath, Fife</i>
Dr Laura Gunn	<i>Salaried/Community Dental Practitioner, Dental Unit, Inverness</i>
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Ms Lynn Naven	<i>Researcher, Dental Public Health Unit, University of Glasgow Dental School</i>
Professor Nigel Pitts	<i>Director of the Dental Health Services Research Unit, University of Dundee</i>
Mrs Sue Prodger	<i>Health Visitor, Greenock</i>
Ms Margaret Ross	<i>Senior Lecturer for Professionals Complementary to Dentistry, Postgraduate Dental Institute, Edinburgh</i>
Dr Jane Scott	<i>Senior Lecturer in Public Health Nutrition, Division of Developmental Medicine, University of Glasgow</i>
Ms Ailsa Stein	<i>Programme Manager, SIGN Executive</i>
Dr Margie Taylor	<i>Consultant in Dental Public Health, Lanarkshire NHS Board</i>
Professor Richard Welbury	<i>Professor of Paediatric Dentistry, University of Glasgow Dental School</i>
Dr Andrew Wight	<i>General Dental Practitioner, Dundee</i>
Dr Charlotte Wright	<i>Senior Lecturer/Consultant in Community Child Health, Yorkhill Hospital, Glasgow</i>

The membership of the guideline development group was confirmed following consultation with the member organisations of SIGN. Declarations of interests were made by all members of the guideline development group. Further details are available from the SIGN Executive.

12.3 SYSTEMATIC LITERATURE REVIEW

The evidence base for this guideline was synthesised in accordance with SIGN methodology. A systematic review of the literature was carried out using an explicit search strategy devised in collaboration with members of the guideline development group.

An initial search for guidelines covered Embase and Medline for the period 1996 – 2003. The following websites were also searched:

American Dental Association
 Canadian Dental Association
 Canadian Practice Guidelines Infobase
 National Guidelines Clearinghouse
 New Zealand Guidelines Group
 National Health and Medical Research Council (NHMRC) - Australia
 Swedish Council on Technology Assessment in Health Care (SBU)
 UK Health Technology Assessment Programme
 US Agency for Healthcare Research and Quality

Searches for systematic reviews, meta-analyses, randomised controlled trials, and observational studies were carried out on the Cochrane Library, Embase, and Medline for the years 1990 – 2003. Searches were later updated to June 2004. Grey literature was not included.

The main searches were supplemented by material identified by individual members of the development group. All selected papers were evaluated using standard methodological checklists before conclusions were considered as evidence.

12.4 CONSULTATION AND PEER REVIEW

12.4.1 NATIONAL OPEN MEETING

The national open meeting is the main consultative phase of SIGN guideline development, at which the guideline development group presents their draft recommendations for the first time. The national open meeting for this guideline was held in May 2004 and was attended by all of the key specialties relevant to the guideline. The draft guideline was also available on the SIGN website for one month to allow those unable to attend the meeting to contribute to the development of the guideline.

12.4.2 SPECIALIST REVIEW

The guideline was also reviewed in draft form by a panel of independent expert referees, who were asked to comment primarily on the comprehensiveness and accuracy of interpretation of the evidence base supporting the recommendations in the guideline. SIGN is very grateful to all of these experts for their contribution to this guideline.

Dr Alan Begg	<i>General Practitioner, Montrose</i>
Ms Cynthia Clarkson	<i>Breastfeeding Counsellor and Research Networker, National Childbirth Trust, Edinburgh</i>
Ms Ursula Corker	<i>Carers Scotland, Dumfries</i>
Dr Derek Cox	<i>Director of Public Health, Dumfries</i>
Ms Pauline Craig	<i>Public Health Programme Manager, Glasgow Centre for Population Health</i>
Dr Morag Curnow	<i>Clinical Dental Director, NHS Tayside</i>
Dr Gill M Davies	<i>Specialist in Dental Public Health, Central Manchester Primary Care Trust</i>
Professor Robin Davies	<i>Director, Dental Health Unit, Manchester</i>
Dr Kim Ekstrand	<i>Associate Professor, University of Copenhagen, Denmark</i>
Ms Tina Everington	<i>Senior Health Promotion Officer Oral Health Unit, Forth Valley NHS Board</i>
Dr Zbys Fedorowicz	<i>Director, UK Cochrane Centre, Bahrain</i>

Mr Andrew Hutchison Professor Elizabeth J Kay	<i>General Dental Practitioner, Saltcoats Professor of Dental Health Services Research, School of Dentistry, University of Manchester</i>
Mrs Lorraine Keith	<i>Tutor for Dental Hygienists, West of Scotland Centre for Postgraduate Dental Education, NHS Education for Scotland</i>
Dr Lesley MacDonald Dr Paula Moynihan	<i>Director of Public Health, Fife NHS Board Senior Lecturer, Nutrition and Oral Health Group, Dental School, University of Newcastle</i>
Ms Wendy Nganasurian Mr David Paul Mr Ian Pocock Mr Derek Richards	<i>Lay reviewer, Culbokie, Rossshire Lay reviewer, Glasgow Registrar, Faculty of General Dental Practitioners (UK) Consultant in Dental Public Health, Forth Valley NHS Board</i>
Dr Elizabeth M Roebuck	<i>Consultant in Paediatric Dentistry, Edinburgh Dental Institute</i>
Dr Martin Tickle	<i>Senior Lecturer in Dental Public Health, University of Manchester</i>
Professor Elizabeth Treasure Ms Susan Watt	<i>Professor of Dental Public Health, Cardiff University Education and Clinical Effectiveness Advisor, Royal College of Nursing Scotland</i>
Professor Lawrence T Weaver Dr Ferranti Wong	<i>Professor of Child Health, University of Glasgow Senior Lecturer/Honorary Consultant in Paediatric Dentistry, Queen Mary's School Of Medicine And Dentistry, London</i>
Dr Edward Wozniak	<i>Chair of the College Specialty Advisory Committee for General Paediatrics, Royal College of Paediatrics and Child Health</i>

12.4.3 SIGN EDITORIAL GROUP

As a final quality control check, the guideline is reviewed by an editorial group comprising the relevant specialty representatives on SIGN Council to ensure that the specialist reviewers' comments have been addressed adequately and that any risk of bias in the guideline development process as a whole has been minimised. The editorial group for this guideline was as follows.

Professor Chris Kelnar Professor Gordon Lowe Professor Jim McDonald	<i>Royal College of Paediatrics and Child Health Chair of SIGN; Co-Editor Faculty of Dental Surgery, Royal College of Surgeons, Edinburgh</i>
Dr Safia Qureshi Dr Sara Twaddle Dr Peter Wimpenny	<i>SIGN Programme Director; Co-Editor Director of SIGN; Co-Editor National Nursing, Midwifery, Health Visiting Advisory Committee</i>

12.5 ACKNOWLEDGEMENTS

SIGN is grateful to the following former members of the guideline development group and others who have contributed to the development of this guideline:

Dr Dawn Adams Dr Michael McDonagh Ms Kathy McGlew Mrs Jackie Mitchell Ms Margaret Robertson Ms Joanne Topalian	<i>Clinical Director, Fife Healthcare Headquarters General Practitioner, Glasgow Breastfeeding Counsellor, Edinburgh Community Midwife, Edinburgh Health Visitor, Dundee Programme Manager, SIGN Executive</i>
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Abbreviations and glossary

ART	Atraumatic restorative technique
Caries	Tooth decay
CI	Confidence interval
Class I and II cavities	Class I cavities affect the biting surface of back teeth; Class II cavities affect the surfaces between teeth
Dentine	Hard tissue, very similar to bone, which makes up the bulk of a tooth, and supports the covering of enamel
Depcat	Deprivation category
dmfs	Decayed, missing or filled surfaces of primary teeth
dmft	Decayed, missing or filled primary teeth
DMFT	Decayed, missing or filled permanent teeth
ECC	Early childhood caries
Enamel	The hard tissue covering the visible surface of the tooth
EU	European Union
Fissure	The grooves on the surface of back teeth, where decay often starts
Fissure sealants	A thin plastic coating applied to protect fissures from decay
Fluorosis	Opaque mottled enamel caused by high fluoride intake
FOTI	Fibre optic transillumination
Free sugars	All added sugars and sugars in juices, honey and syrup
ft	Filled teeth
GDP	General dental practitioner
HBM	Human breast milk
Labial	Relating to the lips
MFP	Monofluorophosphate
mt	Missing teeth
Mutans streptococci	Bacteria associated with dental decay
NaF	Sodium fluoride
NNT	Number needed to treat
Occlusal	The biting surface of a tooth
OR	Odds ratio
PCD	Professions complementary to dentistry
ppmF	Parts per million fluoride
Proximal	The surfaces between the teeth
Pulp	The 'nerve' inside a tooth
Pulpotomy	The procedure where a dentist removes the pulp of a baby tooth to try to avoid extracting the tooth
RCT	Randomised controlled trial
SIGN	Scottish Intercollegiate Guidelines Network
Specialist community public health nurses	Health visitors, family health nurses and school nurses
UK	United Kingdom

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DIAGNOSIS

- As thorough a caries diagnostic examination as the child's level of cooperation permits should be performed.
- D** The use of bitewing radiography for caries diagnosis should be considered for pre-school children attending for dental care, particularly if they are assessed as being at increased risk of dental caries.
- The timing of subsequent radiographic examinations should be based on the patient's caries risk status.
- B** Caries should be diagnosed as early as possible to allow management before cavitation and pulpal involvement, and to identify caries-active patients and those at increased risk of caries in the future.
- C** Practitioners should receive training in clinical and radiographic caries diagnosis.

PREDICTING CARIES RISK

- C** A dental practice based caries risk assessment should be carried out on individual pre-school children and should include the following risk indicators:
 - evidence of previous caries experience
 - resident in a deprived area
 - healthcare worker's opinion
 - oral mutans streptococci counts (if accessible).
- B** Children whose families live in a deprived area should be considered as at increased risk of early childhood caries when developing preventive programmes.

DIET AND NUTRITION

- B** Pregnant women should be advised that there is no benefit to the child of taking fluoride supplements during pregnancy.
- C** Members of the dental team should support and promote breastfeeding according to current recommendations.
- Parents and carers should be advised not to put children to bed with a bottle or feeder cup.
- Parents and carers should be advised that soya infant formulae are potentially cariogenic and should be used only when medically indicated.
- B** Parents and carers should be advised that foods and confectionery containing free sugars should be minimised, and if possible restricted to meal times.

C Parents and carers should be advised that drinks containing free sugars, including natural fruit juices, should be avoided between meals, and should never be put in a feeding bottle. Water or milk may be given instead.

C Parents and carers should be advised that cheese is a good high energy food for toddlers as it is non-cariogenic and may be actively protective against caries.

B Parents and carers should be advised that confectionery and beverages containing sugar substitutes are preferable to those containing sugars.

Parents and carers should be assured that sugar free snacks are unlikely to be cariogenic.

TOOTHBRUSHING WITH FLUORIDE TOOTHPASTE

- A** Children should have their teeth brushed with fluoride toothpaste containing 1,000 ppmF +/- 10%.
- C** Children should have their teeth brushed, or be assisted with toothbrushing by an adult, at least twice a day, with a smear or pea-sized amount of fluoride toothpaste.
- C** Toothbrushing should commence as soon as the primary teeth erupt.
- A** Children should be encouraged to spit out excess toothpaste and not rinse with water post-brushing.
- A** Children's teeth can be brushed with either manual or powered toothbrushes.

COMMUNITY BASED PREVENTION

- A** Community or home based oral health promotion interventions should use fluoride containing agents such as fluoride toothpaste.
- A** Community based toothbrushing programmes should include fluoride toothpaste with a concentration of 1000 ppmF.
- B** Toothbrushing programmes should be undertaken
 - in community based settings such as nurseries
 - with parents to create a supportive environment for oral health behaviour.
- D** Oral health promotion programmes to reduce the risk of early childhood caries should be available for parents during pregnancy and continued postnatally.
- Programmes for young children should be initiated before the age of three years.

C The oral health of young children should be promoted through multiple interventions and multisessional health promotion programmes for parents.

C Teachers, community workers and lay or peer educators can be effective in delivering health promotion interventions and their role should be considered in the development of oral health promotion programmes.

C Professionals should ensure oral health messages are relevant and applicable to communities and lifestyles.

B Caries prevention measures should target 'at-risk' populations and individuals to reduce oral health inequalities.

D Fluoride supplements should only be prescribed by dental practitioners on an individual patient basis.

PRACTICE BASED PREVENTION

- B** The dental health team should deliver caries prevention strategies in conjunction with physical prevention techniques such as the use of fluoride.
- B** Parents and their pre-school children should receive oral health education from their dental team. This should include oral hygiene instruction, the appropriate use of fluoride toothpaste and the provision of fluoride agents such as toothpaste.
- B** Topical fluoride varnish should be applied to the dentition at least twice yearly for pre-school children assessed as being at increased risk of dental caries.

PRACTICE BASED MANAGEMENT

- D** Primary teeth with caries progressing into dentine should be actively managed with a preventive, or a preventive and restorative approach as appropriate with the child's ability to cooperate.
- B** If complete caries removal from a vital primary molar is not possible an indirect pulp capping technique should be considered.
- B** When preparing a Class II cavity, care must be taken to avoid iatrogenic damage to adjacent proximal tooth surfaces.
- B** Use of the ART approach for cavity preparation in carious primary teeth should be considered as an alternative, where appropriate, to conventional cavity preparation techniques.
- A** Amalgam, composite, resin-modified glass-ionomers, compomer or pre-formed metal crowns should be used as restorative materials for Class II cavities in primary molars
- Conventional glass-ionomer should be avoided, where possible, for Class II cavity restoration.