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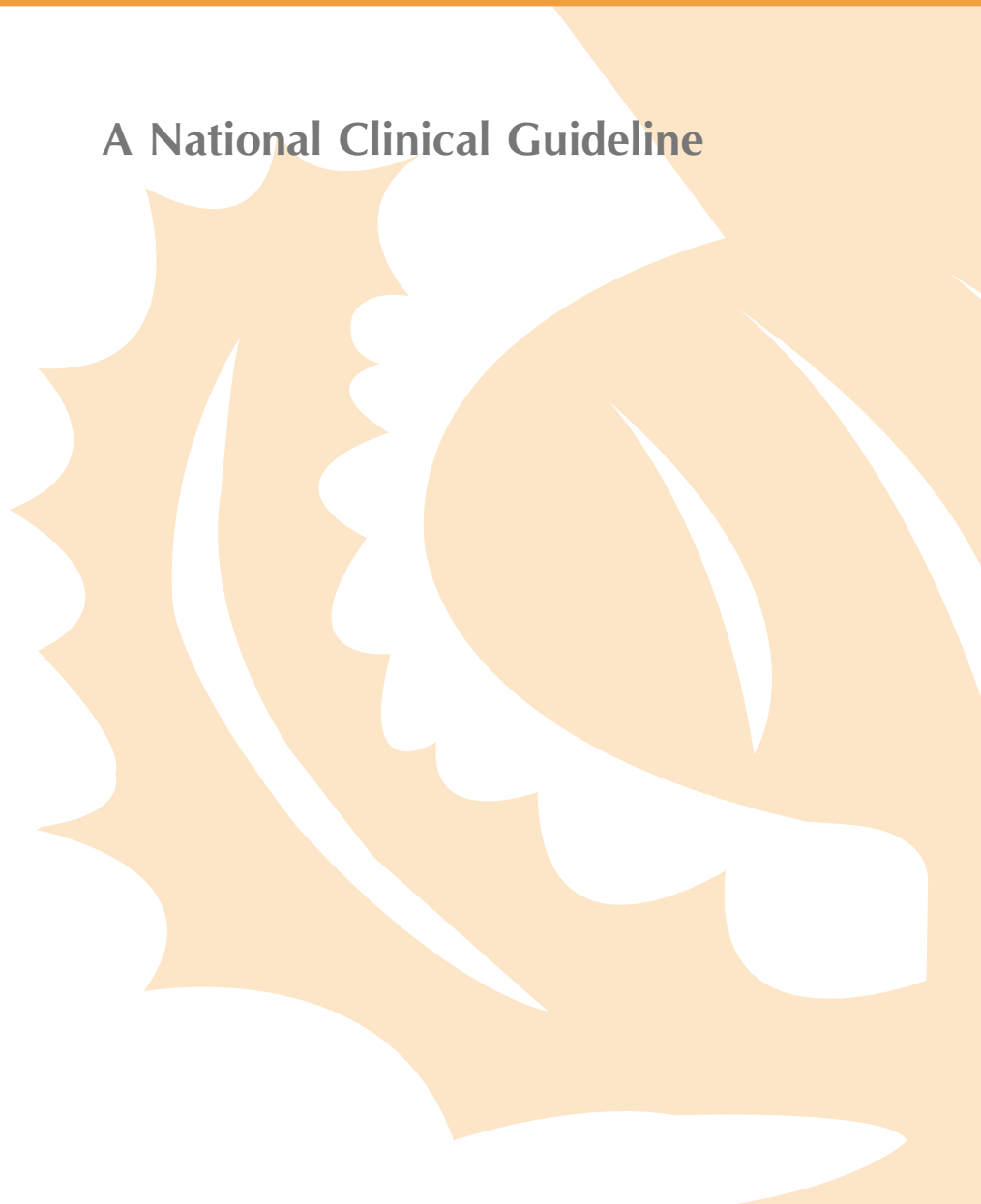
Scottish
Intercollegiate
Guidelines
Network

Preventing Dental Caries in Children at High Caries Risk

Targeted prevention of dental caries in the permanent
teeth of 6-16 year olds presenting for dental care

A National Clinical Guideline

December 2000



KEY TO EVIDENCE STATEMENTS AND GRADES OF RECOMMENDATIONS

The definitions of the types of evidence and the grading of recommendations used in this guideline originate from the US Agency for Health Care Policy and Research¹ and are set out in the following tables.

STATEMENTS OF EVIDENCE

<i>Ia</i>	Evidence obtained from meta-analysis of randomised controlled trials.
<i>Ib</i>	Evidence obtained from at least one randomised controlled trial.
<i>IIa</i>	Evidence obtained from at least one well-designed controlled study without randomisation.
<i>IIb</i>	Evidence obtained from at least one other type of well-designed quasi-experimental study.
<i>III</i>	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.
<i>IV</i>	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

GRADES OF RECOMMENDATIONS

A	Requires at least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation. <i>(Evidence levels Ia, Ib)</i>
B	Requires the availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation. <i>(Evidence levels IIa, IIb, III)</i>
C	Requires evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates an absence of directly applicable clinical studies of good quality. <i>(Evidence level IV)</i>

GOOD PRACTICE POINTS

<input checked="" type="checkbox"/>	Recommended best practice based on the clinical experience of the guideline development group.
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Notes for users of the guideline

DEVELOPMENT OF LOCAL GUIDELINES

It is intended that this guideline will be adopted after local discussion involving clinical staff and management. The Area Clinical Effectiveness Committee should be fully involved. Local arrangements may then be made for the derivation of specific local guidelines to implement the national guideline in individual practices, clinics and hospitals and for securing compliance with them. This may be done by a variety of means including patient-specific reminders, continuing education and training, and clinical audit.

SIGN consents to the copying of this guideline for the purpose of producing local guidelines for use in Scotland.

STATEMENT OF INTENT

This report is not intended to be construed or to serve as a standard of dental and medical 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.

These parameters of practice should be considered guidelines only. Adherence to them 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 dentist or doctor in light of the clinical data presented by the patient and the diagnostic and treatment options available.

Significant departures from the national guideline as expressed in the local guideline should be fully documented and the reasons for the differences explained. Significant departures from the local guideline should be fully documented in the patient's case notes at the time the relevant decision is taken.

A background paper on the legal implications of guidelines is available from the SIGN secretariat.

REVIEW OF THE GUIDELINE

This guideline was issued in December 2000 and will be reviewed in 2002, or sooner if new evidence becomes available. Any amendments in the interim period will be noted on the SIGN website. Comments are invited to assist the review process. All correspondence and requests for further information regarding the guideline should be addressed to:

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Summary of recommendations

PRIMARY PREVENTION OF DENTAL CARIES

Keeping children's teeth healthy before disease occurs

- B** An explicit caries risk assessment should be made for each child presenting for dental care.
- B** The following factors should be considered when assessing caries risk:
 - clinical evidence of previous disease
 - dietary habits, especially frequency of sugary food and drink consumption
 - social history, especially socio-economic status
 - use of fluoride
 - plaque control
 - saliva
 - medical history.

BEHAVIOUR MODIFICATION IN HIGH CARIES RISK CHILDREN

- A** **Dental health education advice** should be provided to individual patients at the chairside as this intervention has been shown to be beneficial.
- A** Children should **brush their teeth** twice a day using toothpaste containing at least 1000 ppm fluoride. They should spit the toothpaste out and should not rinse out with water.
- C** The need to **restrict sugary food and drink** consumption to meal times only should be emphasised.
- B** Dietary advice to patients should encourage the use of **non-sugar sweeteners**, in particular xylitol, in food and drink.
- B** Patients should be encouraged to use **sugar-free chewing gum**, particularly containing xylitol, when this is acceptable.
- B** Clinicians should prescribe **sugar-free medicines** whenever possible and should recommend the use of sugar-free forms of non-prescription medicines.

TOOTH PROTECTION IN CHILDREN AT HIGH CARIES RISK

- A** **Sealants** should be applied and maintained in the tooth pits / fissures of high caries-risk children.
- B** The condition of sealants should be reviewed at each check-up.
- B** Glass ionomer sealants should only be used when resin sealants are unsuitable.
- B** **Fluoride tablets** (1 mg F daily) for daily sucking should be considered for children at high risk of decay.
- B** A **fluoride varnish** (e.g. Duraphat) may be applied every four to six months to the teeth of high caries risk children.
- B** **Chlorhexidine varnish** should be considered as an option for preventing caries.

SECONDARY AND TERTIARY PREVENTION OF DENTAL CARIES

2° *Limiting the impact of caries at an early stage*

3° *Rehabilitation of the decayed teeth with further preventive care*

DIAGNOSIS OF DENTAL CARIES

A **Bitewing radiographs** are recommended as an essential adjunct to a patient's first clinical examination

B The frequency of further radiographic examination should be determined by an assessment of the patient's caries risk.

MANAGEMENT OF CARIOUS LESIONS

Occlusal caries

A If only part of the fissure system is involved in small to moderate dentine lesions with limited extension, the treatment of choice is a composite sealant restoration.

A If caries extends clinically into dentine, then carious dentine should be removed and the tooth restored.

C **Dental amalgam** is an effective filling material which remains the treatment of choice in many clinical situations. There is no evidence that amalgam restorations are hazardous to the general health.

Approximal caries

A **Preventive care**, e.g. topical fluoride varnish, rather than operative care is recommended when approximal caries is confined (radiographically or visually) to enamel.

B In an approximal lesion requiring restoration, a conventional Class II restoration should be placed in preference to a tunnel preparation.

Re-restoration

B The diagnosis of secondary caries is extremely difficult and clear evidence of involvement of active disease should be ascertained before replacing a restoration.

1 Introduction

1.1 BACKGROUND: THE NEED FOR A GUIDELINE

Oral and dental health have improved tremendously over the last century but the prevalence of dental caries in children remains a significant clinical problem which is a priority for the NHS in Scotland.

In addition, dental and oral health have not improved uniformly across the Scottish population. The prevalence of caries is now markedly skewed, with 9% of 5 year olds and 6% of 14 year olds experiencing 50% of the untreated decayed surfaces.^{2,3} (A review of the epidemiology of dental caries, including a report on needs assessment, is available from the Scottish Needs Assessment Programme.^{4,5})

There also appears to be considerable clinical variation in the type of care currently being provided. This may reflect a degree of uncertainty as to which treatments are most useful, who would benefit from treatment and which treatments will achieve cost effective health gain. There are, however, proven professionally and self-applied preventive techniques which can address these problems and which can be targeted to help those with the greatest need.

All health professionals recognise the difficulties in identifying the most appropriate care for their patients. This is as true for dentistry as any other field. There is often a gap between the research identifying an effective clinical practice and its widespread adoption. As the volume of new knowledge and publications increase year on year, this gap becomes wider. Clinical practice guidelines are one available tool to help the practitioner keep up to date and identify best practice.

1.2 THE SCOTTISH INTERCOLLEGIATE GUIDELINES NETWORK

The Scottish Intercollegiate Guidelines Network (SIGN) was established in 1993 by the medical Royal Colleges and their Faculties in Scotland to support the development of evidence-based national guidelines for the NHS in Scotland. The membership of SIGN includes all the medical specialties, nursing, pharmacy, dentistry, professions allied to medicine, and patient representatives.

Clinical practice guidelines have been defined as '*systematically developed statements which assist in decision making about appropriate health care for specific clinical conditions*'.⁶ It is important to emphasise that guidelines do not aim to restrict clinical freedom but to help the clinician identify the optimal management for an individual patient, while recognising that every patient is unique.

SIGN guidelines are developed by multidisciplinary development groups and are based on a systematic review of the evidence of best practice (see Annex 1), following a standard methodology designed to balance scientific rigour with an open and consultative approach.⁷ The guideline recommendations are graded according to the strength of the supporting evidence, enabling areas of relative certainty and uncertainty to be clearly identified by the clinician. (See *inside front cover for definitions of the levels of evidence and grades of recommendations used in the guideline.*)

1.3 REMIT OF THE GUIDELINE

This guideline makes recommendations for the targeted prevention of dental caries in the permanent teeth of 6-16 year olds presenting for dental care.

The focus on this specific group followed widespread concern about the scale of the caries problem in Scottish teenagers, the uneven distribution of the disease in adolescents, and variations in clinical caries management. Effective targeted prevention of caries in the permanent dentition has great potential to achieve significant health gain, given that once an initial filling is placed a repetitive, costly, lifelong cycle of re-restoration occurs for many individuals. Prevention from age six is important if the first permanent molars are to be adequately protected and should build on preventive programmes for 0-5 year olds. Caries prevention in pre-school children is important but is outwith the remit of this guideline.

It was felt that the literature review and guideline should be restricted to those individuals who present for dental care in order to narrow the subject area to a manageable size. General Medical Practitioners have an important role in communicating positive oral health messages to individuals who present for medical care but who do not seek regular dental care; and in encouraging those at high risk of caries to present for dental care.

1.4 STRUCTURE OF THE GUIDELINE

The structure of the guideline has been designed to reflect the philosophy of modern caries management which has emerged from caries research over the last 15 years. Section 2 summarises contemporary terminology and provides definitions. Section 3 deals with primary prevention in terms of caries risk factors, identifying those at high caries risk and consideration of the interventions which have been shown to be effective. Section 4 links both secondary and tertiary prevention as these are often intertwined in clinical practice. Subsequent sections provide relevant information for non-dental health professionals, considerations about implementing the guideline and recommendations for audit and research.

The guideline does not represent a comprehensive account of all possible preventive measures for dental caries. In some cases this is because there is insufficient, high quality research evidence available (to date, randomised controlled trials are infrequently carried out in dentistry). Within this document, gaps in the evidence have been highlighted for future research. In some instances where insufficient evidence has been found, statements are offered representing the consensus view of the multidisciplinary guideline development group as to recommended good clinical practice.

1.5 WHO IS THE GUIDELINE FOR?

This guideline is intended for dentists working in primary dental care (general dental service, community dental service), dental schools and hospitals. However, the guideline has been developed to be of interest to other health care workers including general medical practitioners, health visitors and pharmacists and also to patients. Non-dental health professionals as well as dental professionals have an important part to play in the prevention of dental caries. Section 5 contains more information for non-dental professionals.

2 Definitions and terminology

2.1 DENTAL CARIES

Dental caries is a preventable disease of the mineralised tissues of the teeth with a multi-factorial aetiology related to the interactions over time between tooth substance and certain micro-organisms and dietary carbohydrates producing plaque acids.

2.2 PRIMARY PREVENTION

Primary prevention protects individuals against disease, often by placing barriers between the aetiological agent and the host. It is aimed at keeping a population healthy to minimise the risk of disease or injury. In the context of this guideline, primary prevention is about keeping children's teeth free from dental caries.

2.3 SECONDARY PREVENTION

Secondary prevention aims to limit the progression and effect of a disease at as early a stage as possible after onset. It includes further primary prevention.

2.4 TERTIARY PREVENTION

Tertiary prevention is concerned with limiting the extent of disability once a disease has caused some functional limitation. At this stage, the disease process will have extended to the point where the patient's health status has changed and will not return to the pre-diseased state.

When considering dental caries, tertiary prevention is aimed not only at restoring decayed teeth but must include further primary and secondary prevention in order to prevent further carious attack. This means that in addition to placing a filling the causes of caries must also be addressed as part of clinically effective caries management.

3 Primary prevention of dental caries

Keeping children’s teeth healthy before disease occurs

Assessing caries risk is important for all patients and the process has to be repeated at intervals. Caries-promoting factors may change between visits and on a population level the disease and its sequelae are very widespread in adulthood. This guideline seeks to identify those children who are at greatest risk of future dental decay in time to prevent the ravages of dental caries. However, it must be appreciated that primary prevention will be required in all children to maintain low caries risk status.

A large and comprehensive evaluation of caries risk assessment has demonstrated that, although there are limits to the sensitivity and specificity attainable, practical caries risk assessment in this age group is achievable.^{8, 9}

Evidence level IIIb

B An explicit caries risk assessment should be made for each child presenting for dental care

3.1 RISK FACTORS FOR DENTAL CARIES

There are a wide range of overlapping factors to consider when assessing an individual’s degree of risk from this multifactorial disease. The risk factors described below and summarised in Table 1 were identified from the systematic review undertaken for the Faculty of General Dental Practitioners guidelines on selection criteria for dental radiography.⁹ Additional evidence for the importance of these risk factors is cited in the following sections.

3.1.1 PREVIOUS DISEASE

Past caries experience is the most powerful single predictor of future caries increment (but even so the power is modest). When screening for high caries increment in young children (aged six years), caries in deciduous teeth is a better criterion than caries in permanent first molars.¹⁰

Evidence level IIIb

3.1.2 DIET

Sugars are a major component of our daily diet. Children average nearly seven intakes of food per day,¹¹⁻¹³ many of which are snacks rich in added sugars. Although there are many risk factors for dental caries, the local effect of dietary sugars has a fundamental role in the disease.

Evidence level III

The 1945-1953 Vipeholm study¹⁴ is one of the largest single studies investigating the association between sugar consumption and dental caries. It concluded that consumption of sugary food and drinks both between meals and at meals is associated with a large caries increment. For ethical reasons, this study has never been repeated but the conclusions have been ratified by more recent national reports.^{15, 16}

Evidence level IIa

Several dietary factors are associated with caries incidence:

- amount of fermentable carbohydrate consumed
- sugar concentration of food
- physical form of carbohydrate

Evidence levels II and III

- oral retentiveness (length of time teeth are exposed to decreased plaque pH)
- frequency of eating meals and snacks
- length of interval between eating
- sequence of food consumption.

*Evidence levels
II and III*

However, the key observation is that increasing the frequency of sugar intake increases the odds of developing dental caries, whilst lowering sugar intake can reduce it.¹¹⁻¹⁹

3.1.3 SOCIAL FACTORS

Studies have demonstrated that dental caries is most prevalent in schoolchildren from low socio-economic status families. Children from these families show higher caries prevalence, fewer caries-free teeth, fewer sealants and more untreated lesions.^{20, 21}

Evidence level III

3.1.4 USE OF FLUORIDE

Consideration of water fluoridation as a public health measure is beyond the scope of this guideline, which seeks to make recommendations for those presenting in dental practice. However, there is strong evidence for its efficacy and safety from studies spread over many years²² and fluoridation has been shown to have a particularly beneficial effect on high caries risk, deprived children.²⁰ A rigorous systematic review has recently been published by the NHS Centre for Reviews and Dissemination.

*Evidence levels
IIa and III*

The use of fluoride in tooth protection is considered in sections 3.3.2 and 3.4.

3.1.5 PLAQUE CONTROL

Removal of bacterial plaque is important in minimising one of the aetiological factors in caries. Health benefits are, however, primarily due to the incorporation of fluoride into most toothpastes (see section 3.3.2).

3.1.6 SALIVA

Saliva fulfils a major protective role against dental caries. A small group of children in this age group may have reduced salivary flow – usually as a consequence of their medical history and related drug therapy (see section 5) – and are at high risk of dental caries.

3.1.7 MEDICAL HISTORY AND DISABILITY

A range of factors in a child's medical history may be associated with increased caries risk (see section 5).

A learning disability is not, per se, a predictor of increased caries risk.²³ However, a wide variety of physical and learning disabilities result in decreased ability to perform oral self-care. Learning disability is often associated with poor oral hygiene and frequent consumption of sweet snacks. In this group of patients caries is often untreated and extraction rates are higher.²⁴

Evidence level IIIb

Some disabled patients are resident in institutions where carers are responsible for their oral hygiene. Clinicians should therefore be aware of the need to provide appropriate preventive care to individuals within these groups. These disabilities may also make dental treatment difficult and general anaesthesia may be required.

Table 1

ASSESSING CARIES RISK

	CARIES RISK FACTORS						
	Clinical evidence	Dietary habits	Social history	Use of fluoride	Plaque control	Saliva	Medical history
HIGH RISK	New lesions Premature extractions Anterior caries or restorations Multiple restorations No fissure sealants Fixed appliance orthodontics Partial dentures	Frequent sugar intake	Social deprivation High caries in siblings Low knowledge of dental disease Irregular attendance Ready availability of snacks Low dental aspirations	Drinking water not fluoridated No fluoride supplements No fluoride toothpaste	Infrequent, ineffective cleaning Poor manual control	Low flow rate Low buffering capacity High <i>S mutans</i> & lactobacillus counts	Medically compromised Physical disability Xerostomia Long term cariogenic medicine
MODERATE RISK	Individuals who do not clearly fit into high or low risk categories are considered to be at moderate risk						
LOW RISK	No new lesions Nil extractions for caries Sound anterior teeth No or few restorations Restorations inserted years ago Fissure sealed No appliance	Infrequent sugar intake	Social advantage Low caries siblings Dentally aware Regular attendance Limited availability of snacks High dental aspirations	Drinking water fluoridated Fluoride supplements used Fluoride toothpaste used	Frequent, effective cleaning Good manual control	Normal flow rate High buffering capacity Low <i>S mutans</i> and lactobacillus counts	No medical problems No physical problems Normal salivary flow No long term medication

(Adapted from the table compiled by Professor Edwina Kidd for the Faculty of General Dental Practitioners guidelines on selection criteria for dental radiography.⁹)

3.1.8 CARIES RISK ASSESSMENT

For individual patients, the objective clinical judgement of the dentist, their ability to combine and use these risk factors and their knowledge of the patient has been shown to be one of the most powerful predictors of that individual's caries risk.²⁵ In particular, the dentist's subjective judgement of the size of the 'Decayed', 'Missing' and 'Filled' increment (newly developing caries) over subsequent years is also a relatively strong predictor.⁸

*Evidence levels
IIb and IV*

B The following factors should be considered when assessing caries risk:

- clinical evidence of previous disease
- dietary habits, especially frequency of sugary food and drink consumption
- social history, especially socio-economic status
- use of fluoride
- plaque control
- saliva
- medical history.

- Clinicians should be aware of individuals with a medical or physical disability for whom the consequences of dental caries could be detrimental to their general health. These patients should receive intensive preventive dental care.

3.2 IDENTIFYING CHILDREN AT HIGH CARIES RISK

Given the pattern of development of dental caries and its widespread prevalence in adulthood, most children are "at risk" of dental caries. However, the focus of this guideline is to target those at high caries risk in time to avoid the repeated and increasingly severe and costly consequences of the disease. This targeting requires identification of those individuals who are at increased risk of developing dental caries.

The risk factors for dental caries and a recommended simple risk categorisation are summarised in Table 1. This concept of risk assessment is fundamental to the implementation of this guideline

3.3 BEHAVIOUR MODIFICATION IN HIGH CARIES RISK CHILDREN

3.3.1 DENTAL HEALTH EDUCATION

The goal of dental health education is to establish good oral hygiene and dietary habits. The dental and allied professions have an ethical responsibility to inform patients about disease and how to prevent it.

The establishment of needs-related oral hygiene habits requires long-lasting motivation. The most important motivational factor is a feeling of individual responsibility based on self-diagnosis and behavioural principles.²⁶

Evidence level Ib

A systematic review has demonstrated that dental health education carried out by a professional at the chairside is more often effective than other types of oral health promotion interventions. However, oral health promotion per se has not been shown to be effective for caries prevention unless fluoride is utilised in the intervention.²⁷

Evidence level Ia

This is a controversial area as, in spite of its importance, some issues have been poorly researched^{28,29} and there are design challenges around the use of randomised controlled trials²⁹ which may favour oral health education over broader oral health promotion strategies. However, given that high caries risk patients are presenting in the dental surgery, the following recommendations can be made:

- ☑ The dental and allied professions should carry out dental health education. Consistent preventive messages should be reinforced.

A Dental health education advice should be provided to individual patients at the chairside as this intervention has been shown to be beneficial.

(See Annex 2 for sources of further information and patient education materials.)

3.3.2 ORAL HYGIENE

The value of toothbrushing in caries prevention lies with the regular topical application of fluoride.

Toothpastes containing fluoride at 1000-2800 parts per million (ppm) have been shown to be effective in preventing dental caries in children aged between six and 16 years.^{30, 31} Children who brush twice a day show greater benefit than those who brush less frequently. In addition, rinsing the mouth with a beaker of water after brushing reduces the efficacy of the fluoride toothpaste in the prevention of caries and recurrent caries compared with less diluting methods of clearing the mouth.^{32, 33}

Evidence level Ib

The report of the dental public health consultants in Scotland recommends that adults and children over seven years should:³⁴

- brush teeth twice a day using toothpaste containing at least 1000 ppm fluoride
- ensure that all accessible surfaces of teeth are cleaned
- spit out the toothpaste and avoid rinsing out with water.

Evidence level IV

In children up to seven years of age the report recommends the use of only a smear or small pea-sized quantity of toothpaste and encourages children to spit out toothpaste after brushing. Swallowing toothpaste is discouraged, as is active rinsing out after brushing. The Health Education Authority makes similar recommendations.³⁵

A Children should brush their teeth twice a day using toothpaste containing at least 1000 ppm fluoride, they should spit the toothpaste out and should not rinse out with water.

Considerations about fluoride dosages for infants are outwith the scope of this guideline.

3.3.3 DIET AND SUGAR CONSUMPTION

As discussed in section 3.1.2, lowering sugar intake reduces the incidence of caries in children.¹¹⁻¹⁹ A Brazilian study has shown that the incidence of approximal lesions in 12 year olds can be reduced by diet and oral hygiene training.³⁶ Limiting the ingestion of refined carbohydrate to meal times is also widely recommended.³⁷

Evidence levels III and IV

C The need to restrict sugary food and drink consumption to meal times only should be emphasised.

3.3.4 XYLITOL

Although there is little evidence on the anti-caries effects of other non-sugar sweeteners, a series of studies in Finland have demonstrated that substitution of xylitol for sugar in the diet results in very much lower caries increments.³⁸

Evidence level III

B Dietary advice to patients should encourage the use of non-sugar sweeteners, in particular xylitol, in food and drink.

3.3.5 SUGAR-FREE CHEWING GUM

Chewing gums containing xylitol and sorbitol have anti-caries properties through salivary stimulation. Xylitol is more effective than sorbitol in caries reduction, as it also has antibacterial properties.³⁹

Evidence level IIIb

B Patients should be encouraged to use sugar-free chewing gum, particularly containing xylitol, when this is acceptable.

3.3.6 SUGAR-FREE MEDICINES

Until fairly recently, medicines intended for children have been highly sweetened to make them easier to administer. Little attention was given to the danger to teeth from frequent consumption of sweetened medicines. However, concerns over iatrogenic damage to children's teeth have resulted in the widespread availability of sugar-free alternatives for most paediatric medications.⁴⁰⁻⁴³

Evidence level III

B Clinicians should prescribe sugar-free medicines whenever possible and should recommend the use of sugar-free forms of non-prescription medicines.

See section 5.4 for further information for non-dental professionals on the use of sugar-free medicines.

3.4 TOOTH PROTECTION IN CHILDREN AT HIGH CARIES RISK

3.4.1 SEALANTS

The use of resin pit and fissure sealants has been shown to be an effective barrier method of preventing caries in pits and fissures over a wide range of studies in recent decades. Improvements in dental materials have increased retention and improved technique sensitivity in high caries risk patients. A formal meta-analysis has demonstrated their efficacy.⁴⁴

Evidence level Ia

A Sealants should be applied and maintained in the tooth pits / fissures of high caries-risk children.

The selection of patients who will benefit most from the application of sealant is based on the risk of caries.⁴⁵ Factors that should be considered include medical history and previous caries experience (see Table 1). For the majority of "at risk" individuals sealing permanent molars is sufficient. However in high risk patients all pits and fissures should be sealed.⁴⁵ Details of patient selection and also tooth selection are given in the British Society of Paediatric Dentistry policy document.⁴⁵

Evidence level IV

For optimal efficiency, the sealant should be present in all affected pits and fissures. The condition of the sealant should be reviewed regularly with further coatings added as required.^{46,47}

Evidence level IIIa

B The condition of sealants should be reviewed at each check-up.

Glass ionomer sealants have poorer retention than composite resin materials and their effect on caries reduction is equivocal. Therefore, glass ionomer sealants are mainly used when it is not possible to use a resin material, for example due to poor patient compliance.⁴⁸

Evidence level IIIa

B Glass ionomer sealants should only be used when resin sealants are unsuitable.

3.4.2 FLUORIDE TABLETS

The few scientifically rigorous clinical trials of fluoride supplements undertaken to date, while confirming their caries-inhibiting potential, suggest that the actual contribution of fluoride supplements to caries prevention is slight as compliance amongst those most at risk is problematic.³⁴

Fluoride supplements are no longer recommended routinely for caries prevention in children living in areas with little fluoride in water; nor should they be prescribed for those residing in areas with optimal levels of fluoride in the water. However supplements may still be considered for children with intractable caries risks.⁴⁹ The report of the consultants in dental public health in Scotland³⁴ states that additional fluoride supplements (1mg F, 2.2mg NaF per day⁵⁰) are appropriate for high caries risk children and can be used where compliance is likely to be favourable.

Evidence level IV

Fluoride supplements are available as tablets or as a mouthwash. An eight year school-based study of children initially aged five to six which compared weekly rinsing (0.2% neutral NaF solution) with chewing, rinsing with, and swallowing a tablet daily (2.2mg NaF), concluded that fluoride tablets were the best option.⁵¹

Evidence level IIIa

B Fluoride tablets (1 mg F daily) for daily sucking should be considered for children at high risk of decay.

Ideally, tooth brushing and tablet taking should occur at different times to permit the longest possible period for topical fluoride uptake from each fluoride source.

3.4.3 TOPICAL VARNISHES

For high risk children where reliance on the home based use of fluoride toothpaste and tablets is deemed to be insufficient, professional application of a fluoride varnish may help to prevent dental caries.

A study in Chandigarh, India evaluated the professional application of 2% NaF solution, 1.23% acidulated phosphate fluoride solution (APF), or 2.26% F Duraphat at six-monthly intervals for 30 months in children aged 6-12 years. The largest reduction in caries increment was seen with Duraphat.⁵² However, the authors of this study highlighted the socio-cultural differences between Chandigarh and the West, and some caution may therefore be needed in extrapolating the results of this study to the Scottish population.

Evidence level Ib

A similar study in Finland found no significant difference in three year caries increments in children (aged 12-13 years) who received six monthly applications of either 2.26% F Duraphat varnish or 1.23% APF gel.⁵³

Evidence level IIIb

Applying fluoride varnishes more frequently than twice a year does not provide additional caries protection in a population with relatively low caries activity. A study in Finnish children aged 9-13 years found no statistically significant difference in caries increments between two or four applications of Duraphat per year.⁵⁴

B A fluoride varnish (e.g. Duraphat) may be applied every four to six months to the teeth of high caries risk children.

- Correct application according to the manufacturer's instructions is important. Fluoride concentrations may vary between products and only the recommended amount should be used.

3.4.4 CHLORHEXIDINE

A meta-analysis of clinical studies assessing the caries preventive effects of chlorhexidine has demonstrated that chlorhexidine prophylaxis in the form of a rinse, gel or paste can achieve a substantial (average 46%) reduction in caries irrespective of application method, frequency, caries risk, caries diagnosis, tooth surface, or fluoride regimen.⁵⁵

Evidence level Ia

Professional flossing four times a year with chlorhexidine gel has been shown to lead to significant reductions in approximal caries. This quick (10 minutes) and effective measure can be used in patients with high caries activity to complement the use of sealants in protecting fissures.⁵⁶

Evidence level IIa

In one study, a chlorhexidine varnish (e.g. Cervitec, 1%) was shown to be effective in preventing fissure caries when applied three times over nine months.⁵⁷ An evaluation of a prototype 10% chlorhexidine varnish on Scottish teenagers using a regimen starting with four separate weekly applications followed by annual applications failed to show a significant benefit over conventional preventive care, but this may reflect the particular regimen or formulation used in this trial.⁵⁸

Evidence levels Ib and IIa

B Chlorhexidine varnish should be considered as an option for preventing caries.

4 Secondary and tertiary prevention

2° *Limiting the impact of caries at an early stage*

3° *Rehabilitation of the decayed teeth with further preventive care*

In everyday clinical practice the distinction between secondary and tertiary prevention is unclear and they are therefore considered together in this section. Treating any carious lesions operatively will not prevent further disease and primary preventive measures (see section 3) must be continued.

4.1 DIAGNOSIS OF DENTAL CARIES

In order to deliver effective prevention, accurate diagnosis and monitoring of lesions over time are required.

Early diagnosis of approximal enamel lesions is important as the majority of lesions in the outer half of enamel will take at least two years to progress into dentine⁵⁹ and progression is not inevitable. With intervention, lesion progression can be slowed, arrested or even reversed.⁶⁰⁻⁶⁵ However, monitoring is important as in very caries-active individuals rapid progression can be seen.

*Evidence levels
Ib and III*

Conventional clinical examinations for dental caries have a disappointingly poor sensitivity with the consequence that unaided visual diagnosis fails to detect many lesions, particularly those still at a stage amenable to preventive interventions. There is consequently a range of research underway seeking to identify diagnostic aids with high sensitivity and specificity which do not employ ionising radiation. Although the electrical and optical methods show promise and may lead to important breakthroughs in the near term, at present the use of dental radiography is still indicated.

In the diagnosis of caries in children, systematic review of the evidence, supported by expert opinion, shows that posterior bitewing radiographs are an essential adjunct to clinical examination.^{9, 66} An apparently increasing problem exists in detecting dental caries 'hidden' under an apparently sound occlusal surface. Radiographic examination has been shown to reveal these lesions,⁶⁷⁻⁶⁹ which may affect 10-15% of teenagers. However, no patient should be expected to receive additional radiation dose and risk as part of a course of dental treatment unless there is likely to be a benefit in terms of improved management of the patient.

*Evidence levels
Ia, Ib and IV*

- A thorough clinical examination of clean, dried teeth should be carried out to assist caries diagnosis and to identify the patient's caries risk category prior to deciding whether to take a radiograph. This examination may include:
 - transillumination
 - flossing
 - temporary separation of the teeth (e.g. with a wooden wedge or orthodontic separator).

A Bitewing radiographs are recommended as an essential adjunct to a patient's first clinical examination.

B The frequency of further radiographic examination should be determined by an assessment of the patient's caries risk (see Table 1).

For further details of selection criteria for dental radiography and optimal timing for recall intervals, see the Faculty of General Dental Practitioners guideline.⁹

4.2 MANAGEMENT OF CARIOUS LESIONS

The management of carious lesions can be divided into three caries sites:

- occlusal caries
- approximal caries
- smooth surface caries.

The patterns of caries initiation and progression are different in each site, as are the management options.

4.2.1 MANAGEMENT OF OCCLUSAL CARIES IN CHILDREN AT HIGH CARIES RISK

Once a decision has been taken to initiate operative intervention, it has been shown that sealant restorations are as effective as amalgam restorations in managing small to moderate sized fissure caries⁷⁰⁻⁷² and involve less tooth destruction.⁷² However, it must be appreciated that the fissure sealant component requires maintenance.⁷⁰⁻⁷³ Using composite instead of glass ionomer improves sealant retention.^{73,74} If amalgam is used as a filling material, any remaining fissures which are caries free should be fissure sealed in preference to "extension for prevention".⁷⁵

Evidence level Ib

A If only part of the fissure system is involved in small to moderate dentine lesions with limited extension, the treatment of choice is a composite sealant restoration.

If fissure caries extends clinically into dentine, the current treatment of choice is to remove the caries and place a restoration, rather than sealing over the caries.⁷⁶⁻⁷⁸ The evidence for the longevity of conventional restorations in this type of application is clear, although further studies with new materials and techniques are required. However, if caries is inadvertently covered by a fissure sealant *which is then well maintained*, the caries is very unlikely to progress.⁷⁹⁻⁸³

Evidence level Ib

A If caries extends clinically into dentine, then carious dentine should be removed and the tooth restored.

For more extensive lesions still there is a wealth of evidence to support the use of well placed conventional amalgam fillings. Concerns about mercury related hazards have not been generally substantiated^{84,85} and are offset by equivalent, although questionable, concerns about potential oestrogen depleting effects of resin monomers associated with the dental polymers that are the most popular alternative materials.^{86,87}

Evidence levels Ia, III and IV

C Dental amalgam is an effective filling material which remains the treatment of choice in many clinical situations. There is no evidence that amalgam restorations are hazardous to the general health.

Current advice from the Department of Health is that amalgam fillings should not be used for pregnant women.⁸⁸

4.2.2 MANAGEMENT OF APPROXIMAL CARIES IN CHILDREN AT HIGH CARIES RISK

Application of fluoride varnish can slow or arrest progression of approximal enamel lesions and therefore operative intervention is not indicated when lesions are at this stage of development.^{63, 64, 89}

Evidence level Ib

A Preventive care (e.g. topical fluoride varnish) **rather than operative care is recommended when approximal caries is confined** (radiographically or visually) **to enamel.**

- Management strategies for lesions confined to the enamel should also include:
 - twice daily use of a toothpaste containing at least 1000 ppm fluoride
 - flossing
 - dietary advice.

For approximal lesions requiring restoration, a Class II approach should be used in preference to a tunnel preparation, which is technically very demanding and has been shown to have limited durability.^{90, 91} Composite resin is suitable for the restoration of small to moderate sized (not subjected to direct occlusal loading) Class II cavities in premolar teeth.⁹²

Evidence level IIIb

B In an approximal lesion requiring restoration, a conventional Class II restoration should be placed in preference to a tunnel preparation.

4.2.3 MANAGEMENT OF SMOOTH SURFACE CARIES IN CHILDREN AT HIGH CARIES RISK

In free smooth surfaces, caries is easier to detect and manage.⁹³ The management strategy is the same as that for approximal lesions confined to enamel.

- Management strategies for smooth surface (non-cavitated) lesions should include:
 - twice-daily use of a toothpaste containing at least 1000 ppm fluoride
 - plaque removal
 - dietary advice
(including the use of sugar free chewing gum, when acceptable).

4.3 RE-RESTORATION

It is common to find a range of previous restorations in high risk patients. Restorations may fail for a number of reasons, including factors associated with the material or technique used or the operator's skill. However, for high caries-risk children, further decay is a particular problem. The margin between restoration and tooth tissue is a potential site for new decay, known as secondary or recurrent caries. More extensive lesions which continue to progress in spite of preventive care should be restored with an appropriate material depending on their degree of visibility.

However, the diagnosis of secondary caries is extremely difficult and there is a risk that large numbers of false diagnoses of secondary caries will lead to unwarranted replacement and re-replacement of fillings. Unnecessary replacement of fillings is deleterious to oral health and wastes scarce financial resources.⁹⁴⁻¹⁰¹

Evidence level IIIa

B The diagnosis of secondary caries is extremely difficult and clear evidence of involvement of active disease should be ascertained before replacing a restoration.

- If only part of a restoration is judged to have failed, then consideration should be given to repairing rather than replacing it.

5 Information for non-dental health professionals

Although much of this guideline is concerned with the practice of dentistry within the dental surgery, other health professionals also have an important role in the prevention of dental caries in children.¹⁰²

Areas where non-dental health professionals have a role to play include:

- care of the medically compromised
- care of those who do not attend a dentist regularly
- care of those at “high risk” of caries development
- prescription of liquid medications, which should be sugar-free if possible
- advice on sugar-free over-the-counter (non-prescription) medicines.

A brief description of the process of the development of dental caries aimed at the non-dental health professional is given for background information.

5.1 DENTAL CARIES DEVELOPMENT

Dental caries is a disease of mineralised tissue of teeth caused by the action of micro-organisms on dietary carbohydrates, especially sugar. These micro-organisms live in a dense layer or bio film called dental plaque which forms on the tooth surface as soon as the tooth has erupted and reforms over hours following removal.

There are many bacteria in dental plaque, but the most important in the aetiology of dental caries are *Streptococcus mutans* and *Lactobacilli*. These bacteria metabolise sugars to generate local concentrations of organic acid in the inner layers of plaque on the tooth surface, which lowers the pH at the tooth surface. When the pH at the tooth surface falls, a process of demineralisation occurs and calcium and phosphates diffuse out of the tooth enamel. When the pH at the tooth surface rises again this process is reversed and remineralisation occurs. However, if demineralisation predominates over remineralisation over a period of time in a susceptible tooth, sub-surface softening of the enamel occurs. If the lesion progresses this is followed by “cavitation”, forming a carious cavity. Caries development is more likely at inaccessible areas where plaque is undisturbed.

The mean time for caries to be confined to the enamel radiographically varies considerably but a mean of 3-4 years was suggested some years ago. Mean times are more extended now, although progression is faster in high caries risk individuals.

Decreasing the amount and frequency of sugary intake and increasing the presence of saliva are important factors in the reduction and control of dental caries. Prevention can also be achieved by effective removal of plaque by diligent brushing and flossing, and tooth strengthening by provision of fluoride and fissure sealants. Tooth brushing with fluoride toothpaste both removes plaque and provides fluoride.

Dental erosion (tooth surface loss) is a different process from dental caries and is outwith the scope of this guideline. In erosion the enamel of the tooth is attacked by acid not created by micro-organisms in the plaque but from outwith the mouth, commonly ingested but possibly due to reflux. Erosion in 6-16 year olds is often seen in combination with high consumption of carbonated drinks and fruit juices.

5.2 SUGAR CONSUMPTION

The evidence that sugar causes dental caries is widely accepted. Within a few minutes of ingesting sugar, the pH at the surface of the tooth falls and may take between 20 minutes and several hours to recover fully. The length of time it takes for the tooth surface pH to return above the critical level (at which demineralisation occurs) depends upon the quantity and “stickiness” of the sugar intake. If further sugary loads are taken before the pH at the tooth surface recovers, prolonged demineralisation occurs.

- Patients should be advised to decrease both the quantity and frequency of their sugar intake. In particular they should avoid sugary snacks between meals and immediately before bedtime.

There may be a small number of children who have special dietary requirements affecting sugar intake and these patients need to be managed appropriately.

5.3 DRY MOUTH

The importance of saliva in counteracting demineralisation is often underestimated. The importance of saliva is most clearly appreciated in its absence. Patients with severe dry mouth are at risk of rampant caries (sudden rapid destruction of many teeth, frequently involving surfaces that are ordinarily caries-free).

There are several mechanisms by which saliva acts to prevent dental caries:

- it has a buffering effect which alters the plaque pH
- it washes away plaque and food debris
- it has an antibacterial action
- it contains a reservoir of minerals such as calcium and phosphates and, under certain circumstances, fluoride.

Certain foodstuffs, e.g. cheese, and sugar-free gum cause the stimulation of salivary flow. These foodstuffs therefore have a beneficial effect after a meal.

Dry mouth can be caused by drugs, e.g. anticholinergics and tricyclic antidepressants, disease, e.g. Sjogren/Sicca syndrome, diabetes, ectodermal dysplasia, and may occur following radiotherapy. Patients may not realise that dry mouth is a symptom for concern, especially if they perceive themselves to be coping, e.g. by taking frequent drinks. Knowledge of the importance of dry mouth to the dentition may encourage direct questioning to ascertain the presence of predisposing risk factors for dry mouth.

Artificial saliva is available on prescription. Only one (Luborant) is licensed for any condition causing dry mouth. Others are accredited for Sicca syndrome or post-radiotherapy only.

- Non-dental professionals should be aware of the markedly increased risk of dental caries in the presence of dry mouth.
- Low sugar artificial saliva and/or sugar free chewing gum should be considered for patients with dry mouth as appropriate.

5.4 SUGAR-FREE MEDICINES

Sugar-free medicines are defined as oral liquid preparations that do not contain fructose, glucose or sucrose. Preparations containing hydrogenated glucose syrup, manitol or sorbitol are also classified as sugar-free as there is evidence that they are not cariogenic.¹⁰³

Although it is easy to imagine that the amount of sugar in sugar-containing oral medicines is not significant, research has shown an association between sugar-containing oral medicines and dental caries.^{40, 41, 104} Prescription of sugar-free medication is important if treatment is long term (daily or alternate days for more than three months). This is particularly relevant because many of the children receiving long term medication are medically compromised and their dental treatment is already associated with increased difficulty.

The 1989 Report from the Committee on Medical Aspects of Food and Nutrition Policy (COMA) recommended that the Government should seek means to reduce the use of sugared liquid medicines.¹⁰⁵ This is within the power of the prescribing doctor in most cases. The Scottish Executive has also published a report by the National Pharmaceutical Advisory Committee⁴³ which advises that sugar-free medicines should be used wherever possible.

- Doctors should be aware of the risk of dental caries from sugared medicines and consider this when making their prescribing choices.
- Dispensing pharmacists should be encouraged to substitute sugar-free versions of prescribed and non-prescribed medicines whenever it is appropriate and in the interests of the child to do so.

There are now sugar-free alternatives to most commonly used liquid medicines. Long term treatment with anti-convulsants and antibiotics for cystic fibrosis and recurrent urinary tract infections, the most common indications for long-term treatment¹⁰⁶ are possible in most cases without the use of sugared medicines. There are sugar-free versions of most common antibiotics, cough medicines and paracetamol mixtures which can be prescribed by doctors. Simple linctus is frequently prescribed although it is high in sugar content. Traditional honey and lemon cough medicines available over the counter are also popular and high in sugar content. In the case of Methadone, which may be prescribed to teenagers at the older end of the guideline age range, there is a sugar-free variant.

Prescribers should also be aware that the timing of medication has an impact on caries prevention. For example, lactulose, which is commonly used for the treatment of constipation in childhood, is less cariogenic than sucrose but it is often given at night before retiring when it could be given with an evening meal.¹⁰⁷

To ensure a sugar-free preparation is dispensed a medical practitioner should add "sf" to the prescription. In the 85% of GP practices in Scotland using GPASS, the sugar-free preparations of a selected drug are listed in the menu of alternatives. If a prescription is not written specifically for a sugar-free preparation, the pharmacist can endorse the prescription, dispense a sugar-free preparation and be reimbursed by the Pharmacy Practice Board. In many cases the sugar-free alternative is the same price as the sugared preparation or only marginally more expensive.

5.5 THOSE WHO DO NOT ATTEND A DENTIST REGULARLY

Regular dental examination, at least once a year, is important for caries prevention and management. However, only 55% of Scottish children under 18 were registered with a dentist in 1995/96.¹⁰⁸ This suggests that many children in the target age group of this guideline do not undergo regular dental checks.

The main barriers to attending a dentist have been identified as fear, the organisation and image of dental practices and cost¹⁰⁹ (although direct patient charges are not an issue for children). Dental indifference and apathy also play a part.

In other age groups patients have been successfully encouraged to register with a dentist by a member of their primary care team.¹⁰¹ The primary care team may be able to counsel patients who do not attend a dentist, and help them to overcome their own particular barriers to dental care. Medical practitioners can also help promote good oral health by providing dental advice to their patient when dental caries is discovered. Dental advice could also be introduced into appropriate clinics, such as an asthma clinic.

- GPs should actively encourage high caries risk children to attend for dental care.

5.6 MEDICALLY COMPROMISED

This group includes those with a condition that makes dental treatment more hazardous, and includes patients with:

- cardiac disease
- immunosuppression, including HIV
- haemophilia and other bleeding disorders
- disability.

Patients in these groups may be more susceptible to poor oral health and subsequent caries development and / or dental treatment may be hazardous. By careful attention to preventive dental care, the need for dental treatment may be minimised. Many of these patients see their doctor, primary care team member, or hospital specialist regularly. There is an opportunity, therefore, for the non-dental health professional to promote caries prevention in these patients by encouraging them to attend a dentist.

Congenital heart disease is important in this age group. There is an increasing number of children who have undergone successful cardiac surgery but may still be predisposed to infective endocarditis. Children with heart defects should receive maximal preventive dental care, to minimise the need for dental surgical procedures. However, there is evidence from the North East of England that such children are under-registered.¹¹⁰

To address the prevention of infective endocarditis, the recommendations of the British Society for Antimicrobial Chemotherapy¹¹¹ have been widely accepted and are reproduced in the BNF. It is important that patients at risk are well informed about the problem. Obtaining an accurate medical history is the simplest way to identify these patients. However, medical history given to a dentist by a patient may not be accurate. A recent review of 53 cases involving litigation between the infective endocarditis patient and their dental practitioner found that in 10 of the 53 cases no medical history had been obtained.¹¹² In a further 31 cases the medical history was inadequate or out of date.

5.7 ORTHODONTIC APPLIANCES

Wearing orthodontic appliances is a risk factor for the development of dental caries. Ordinarily a patient receiving orthodontic treatment is seen regularly by their dentist. However, patients sometimes default from dental care and treatment, so non-dental health care professionals should be aware of the risk of caries in children wearing orthodontic appliances.

6 Implementing the guideline

6.1 LOCAL ADAPTATION AND IMPLEMENTATION

This is a nationally agreed guideline which may require adaptation to meet local conditions and restraints. For example parts of the national guideline may have to be adjusted to conform with the structures set out in the general dental service contract or in practice protocols. The framework and contents of this national guideline should therefore be adapted actively to local situations so that the guideline can best influence the clinical care of children across Scotland.

A model is presented in Figure 1 which was successfully used to produce and implement local guidelines following publication of the SIGN guideline on prevention of visual impairment in diabetes.

6.2 HEALTH SERVICE IMPLICATIONS OF IMPLEMENTATION

This guideline is consistent with the policies and priorities set out in the Scottish Executive's Action Plan for Dental Services in Scotland.¹¹³ Implementation of this guideline will help ensure a more consistent approach towards primary and secondary caries prevention across Scotland. Successful implementation requires the full involvement and co-operation of other primary care professionals, who have an undeniable role to play in caries prevention. Appropriate training and support will be required by the primary care team, which will have resource implications for both Health Boards and Trusts.

If the guideline is to be successfully implemented at both national and local level, Health Improvement Programmes (HIPs) and Trust Implementation Plans (TIPs) need to address caries prevention and the recommendations in this guideline. In addition, implementation will require close collaboration within the dental profession between the general, community and hospital dental services, as well as between the dental profession and other health care professionals.

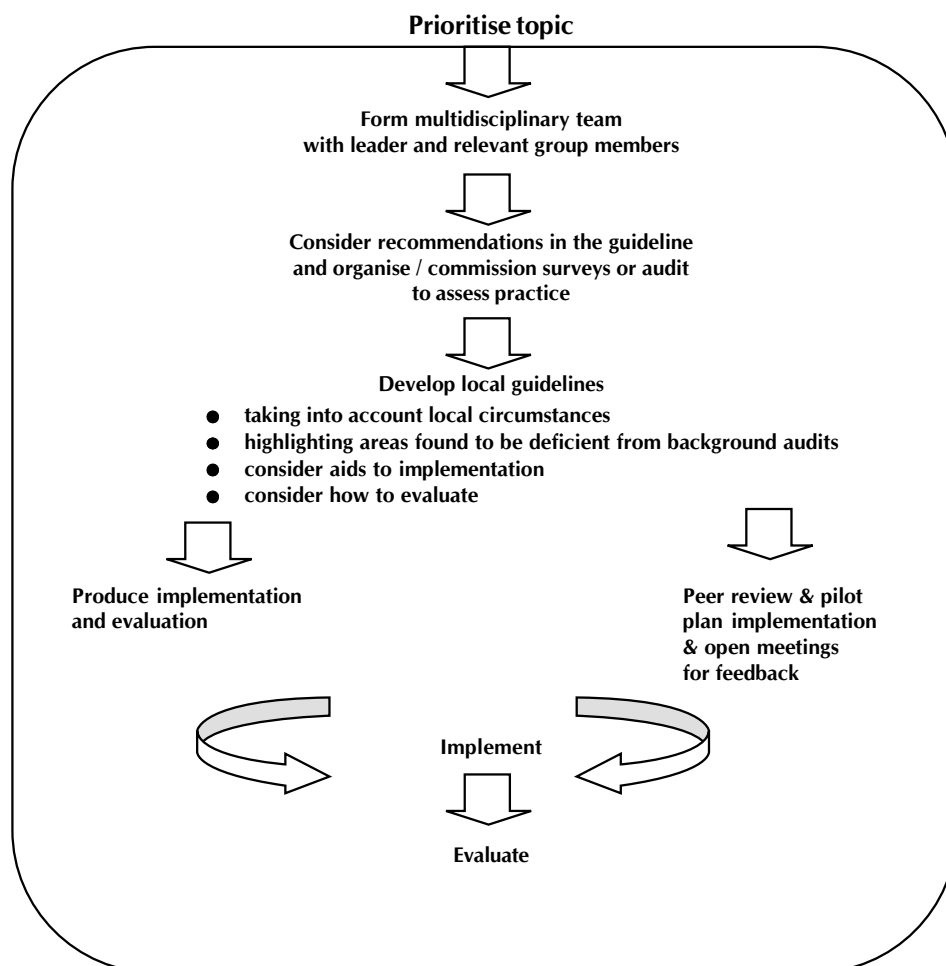
Successful implementation of the guideline will contribute to a lower prevalence of dental disease amongst the target age group and drive down costs associated with treating the disease. In 1997/98 the cost to NHS General Dental Services of amalgam fillings alone was £2.3 million for Scottish 0-17 year olds.¹¹⁴ Investment in prevention may reap savings to the NHS in the future. It is hoped that current methods of payment will not adversely influence implementation of the recommendations made in this guideline, as studies have shown this to be a factor.¹¹⁵

Some sugar-free medicines cost more than those containing sugar. Increased prescribing of sugar-free medicines will initially increase the NHS spend on drugs. However, it is hoped that the increased demand for sugar-free medicines will encourage drug companies to increase the manufacture of such products, driving down production costs.

Successful implementation and audit of any guideline requires time. At present, general dental practitioners do not receive an income if they are not actually treating patients. Health Boards and Trusts should make appropriate arrangements to reimburse practitioners during implementation and audit of local guidelines, as part of their clinical governance activities.

Figure 1

EXAMPLE MODEL FOR GUIDELINE IMPLEMENTATION



Produced with the kind permission of Dr Janet McCarlie, Clinical Epidemiologist and Local Audit Co-ordinator for General Practice, Ayrshire & Arran Health Board

6.3 IMPLEMENTATION ISSUES FOR LOCAL DISCUSSION

The following issues were raised by specialist reviewers during development of the guideline and might provide a starting point for discussions as part of the process of local implementation of the guideline:

- **Catch phrases**
During a recent pilot of implementation of locally agreed guidelines based on the draft SIGN guideline, the use of small catch phrases was particularly liked by members of the dental team. For example, “SPIT DON’T RINSE” was a short snappy phrase widely used and disseminated. Further use of appropriate catch phrases might prove a useful implementation tool.
- **Patient information**
This guideline contains a wealth of valuable information for the dental profession and non-dental professionals. As the trends in health care move to self empowerment, this might be used as a tool to encourage personal responsibility for dental health by development into specific advice and guidance for interested parents, carers, or teachers. Dissemination of appropriate information into the public domain with loud clear messages of personal responsibility and how to effectively apply this may be helpful in counterbalancing the oral effects of a huge change in social (including dietary) habits over the past 10 years.
- **Parental/carer responsibility in oral hygiene.**
Publicity would be useful for the important and effective contribution of supervision/encouragement and/or physically providing regular oral hygiene routines in the child’s own environment.
- **Radiography**
Frequency of bitewing radiographs is an essential element of prevention in children at high caries risk and might be given greater prominence in local guidelines.

7 Recommendations for audit and research

7.1 KEY POINTS FOR AUDIT

- Oral hygiene status and chairside preventive advice.
- Number of patients at high caries risk due to social or demographic factors.
- The attendance profile of high caries risk / experience children.
- Toothpaste usage and therapeutic appropriateness.
- Application of fissure sealants according to British Society of Paediatric Dentistry recommended categories of need.
- Sealant maintenance at recall.
- Sealant retention.
- Use of preventive varnishes in high caries risk patients.
- Bitewing radiograph usage and quality in high caries risk patients.
- Management of early occlusal caries by sealant restoration.
- Management strategies for patients at high caries risk due to xerostomia.
- Interdisciplinary management of patients with congenital cardiac defects.
- Interdisciplinary management of high caries risk patients on long-term oral medication.

7.2 RECOMMENDATIONS FOR FUTURE RESEARCH

During the retrieval and critical appraisal of evidence for this guideline it became apparent that there is a shortage of high quality, rigorous and methodologically sound research in many areas touching upon the remit of the guideline development group. Recommended areas for further research include:

- Development and evaluation of practical aids to caries risk assessment for 6-16 year olds in a primary care setting.
- Studies of the relative efficacy in the post fluoride toothpaste era of preventive interventions in high caries sub-groups assessing agents singly and in combination.
- Methods of assessing the activity of primary caries lesions.
- Evidence and methodologies to assess reliably the presence and activity of secondary caries.
- Studies evaluating how best clinicians might record and use the information needed for monitoring caries status and activity over time.
- Effectiveness of educating parents and carers of children at high caries risk.
- Bitewing radiograph use in a primary care setting.

Annex 1

DEVELOPMENT OF THE GUIDELINE

The guideline development group met on eight occasions between April 1997 and January 1999, with further meetings of sub-groups taking place in addition to correspondence between group members. Early in the guideline development patient representatives were invited to join the development group, these representatives opted instead to participate once draft guidelines were available. Initial meetings considered a wide range of issues related to caries prevention in adolescents.

The literature review conducted for this guideline covered the Cochrane Library, Issue 2 1997, plus searches of Medline and Healthstar from 1985 to 1997. The evidence base was updated during the course of development of the guideline. Reference lists, existing systematic reviews, and guideline developer's own resources were used to trace older material. In view of the limited number of trials identified, the Medline and Healthstar searches were extended to cover all types of literature. Root caries was specifically excluded from the literature searches.

Successive drafts were developed by synthesis of the literature, correspondence and full discussion at a National Open Meeting held in Edinburgh at the Royal College of Physicians, Edinburgh in March 1998. The guideline was submitted, in draft, for external peer review. Feedback from the National Meeting, specialist reviewers and other groups including a large audit group from the Health Boards was considered in detail by the guideline development group.

Annex 2

SOURCES OF FURTHER INFORMATION

RESOURCES ON THE WORLDWIDE WEB

Health Education Board for Scotland

- looking after children's teeth

<http://www.hebs.scot.nhs.uk/publics/teeth/teeth1.htm>

- information on journal articles, leaflets and books available on dental health

<http://www.hebs.scot.nhs.uk/menus/oral.htm>

- information on healthy foods and drinks

<http://www.hebs.scot.nhs.uk/publics/food/food1.htm>

British Dental Health Foundation

Tell me about preventive care & oral hygiene

<http://www.dentalhealth.org.uk/tellme/prevent.htm>

- leaflet offering information about preventive dentistry. What it is, what is involved, what plaque is, the hygienist's role, and self help are amongst the topics discussed.

Price: single copies free, multiples sold in 100s: BDHF members £8.65 + postage; non-members £11.53 + postage.

British Dental Health Foundation Eastlands Court, St Peter's Road, Rugby, Warwickshire CV21 3QP. Tel: 01788 546365 Fax: 01788 541982 E-mail: feedback@dentalhealth
[Advertising: Sponsored by Braun Oral-B]

British Dental Association

- an informative website

<http://www.bda-dentistry.org.uk/public/index.html>

Dental Practice Board (England and Wales)

Dentanet – gateway to dentistry and oral health on the world wide web

<http://www.dentanet.org.uk/dentanet/public/index.cfm>

Taking care of your teeth

- a well-planned American web site aimed specifically at teenagers

http://kidshealth.org/teen/body_basics/teeth.html

LEAFLETS AND BROCHURES

Health Education Board For Scotland

Copies available from local Health Board Health Promotion Units. Single copies can also be obtained from the Sales and Distribution Officer of the Health Education Board for Scotland (tel: 0131 536 5500 fax: 0131 536 5501), multiple copy orders are charged for.

Do You Take Sugar?

Considers how sugar affects your teeth, how sugar is 'hidden' in a large selection of food stuffs, ways in which to cut down sugar consumption, healthier food and drink options, in terms of sugar content. Price: free in Scotland only, price for multiple copies: £0.30 each. Glossy, full colour (approx. 7 pages illustrations).

The Scientific Basis Of Dental Health Education. A Policy Document

Lists the recent evidence on the cause and prevention of dental disease. The basic text for all professionals wishing to update their knowledge in this important and often confusing area of oral health promotion. It takes account of the changing patterns in dental disease over the last 5 years. In Britain there is clear a North / South regional divide in the incidence of dental disease – Scotland, Wales and Northern Ireland have higher figures in comparison with the south of England. This is emphasised by giving separate epidemiological figures for each of the UK regions. Price: £0.95. Printed black and white A5 (24 pages).

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Department of Dental Health Promotion and Epidemiology

Ayrshire & Arran Primary Care Trust, Ayrshire Central Hospital, Irvine KA12 8SS

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Tooth Care Tips A Guide For Those With Special Needs

Leaflet using humorous graphics to give advice on diet, toothbrushing, and visiting the dentist. Price: £7.00 per 25 copies. Photocopied black and white A5 (10 pages of cartoons).

Hemming Visual Aid

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Tel: 01604 634289 Fax: 01604 620002 e-mail: hva-k9@compuserve.com

Going To The Dentist

Colour paperback book for children under 5 to 7 years. Describes a family check up at a dental surgery. £2.99 + VAT. Full colour, 16 pages illustrations.

Going To The Dentist pop-up book

Hardback pop-up book aimed at preparing and reassuring children under 5 for a visit to the dentist. £4.95 + VAT. Full colour, illustrations.

Postman Pat's Sore Tooth

Paperback book in which Pat's sticky toffee means a visit to the dentist. £3.50 + VAT.

Topsy And Tim Visit The Dentist

Paperback book aimed at children under 5 to 7 years preparing and reassuring children for a visit to the dentist. £2.25 + VAT.

Pictorial Charts Educational Trust

27 Kirchen Road, London W13 0UD. Tel: 0181 567 9206

Your Teeth - We Care

Colour chart 70 x 100cm illustrating the structure of a tooth, how to look after your teeth and how those working at a dentist's surgery help you to look after your teeth. £8.27.

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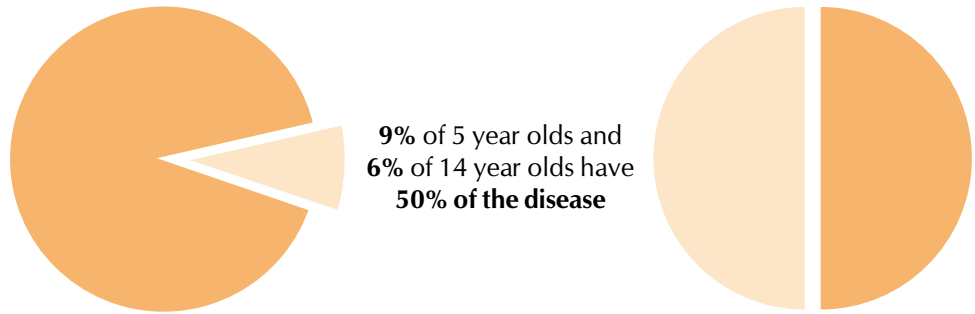
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Quick Reference Guide

Targeted prevention of dental caries in the permanent teeth of 6-16 year olds presenting for dental care

PRIMARY PREVENTION: *Keeping children's teeth healthy before disease occurs*

Targeting is important as decay is unevenly distributed in the population:



B An explicit caries risk assessment should be made for each child presenting for dental care. The following factors should be considered:

RISK FACTORS	RISK CATEGORY	
	HIGH RISK	LOW RISK
Clinical evidence	<ul style="list-style-type: none"> – New lesions – Premature extractions – Anterior caries or restorations – Multiple restorations – No fissure sealants – Fixed appliance orthodontics – Partial dentures 	<ul style="list-style-type: none"> – No new lesions – Nil extractions for caries – Sound anterior teeth – No or few restorations – Restorations inserted years ago – Fissure sealed – No appliance
Dietary habits	<ul style="list-style-type: none"> – Frequent sugar intake 	<ul style="list-style-type: none"> – Infrequent sugar intake
Social history	<ul style="list-style-type: none"> – Social deprivation – High caries in siblings – Low knowledge of dental disease – Irregular attendance – Ready availability of snacks – Low dental aspirations 	<ul style="list-style-type: none"> – Social advantage – Low caries in siblings – Dentally aware – Regular attendance – Limited availability of snacks – High dental aspirations
Use of fluoride	<ul style="list-style-type: none"> – Drinking water not fluoridated – No fluoride supplements – No fluoride toothpaste 	<ul style="list-style-type: none"> – Drinking water fluoridated – Fluoride supplements used – Fluoride toothpaste used
Plaque control	<ul style="list-style-type: none"> – Infrequent, ineffective cleaning – Poor manual control 	<ul style="list-style-type: none"> – Frequent, effective cleaning – Good manual control
Saliva	<ul style="list-style-type: none"> – Low flow rate – Low buffering capacity – High <i>S mutans</i> and <i>lactobacillus</i> counts 	<ul style="list-style-type: none"> – Normal flow rate – High buffering capacity – Low <i>S mutans</i> and <i>lactobacillus</i> counts
Medical history	<ul style="list-style-type: none"> – Medically compromised – Physical disability – Xerostomia – Long term cariogenic medicine 	<ul style="list-style-type: none"> – No medical problems – No physical problems – Normal salivary flow – No long term medication

Individuals who do not clearly fit into high or low risk categories are considered to be at moderate risk.



A B C

indicates grade of recommendation



good practice point

PRIMARY PREVENTION IN CHILDREN AT HIGH CARIES RISK

▶ BEHAVIOUR MODIFICATION

- A **Dental health education advice** should be provided to individual patients at the chairside as this intervention has been shown to be beneficial.
- A Children should **brush their teeth** twice a day using toothpaste containing at least 1000 ppm fluoride. They should spit the toothpaste out and should not rinse out with water.
- C The need to **restrict sugary food and drink** consumption to meal times only should be emphasised.
- B Dietary advice to patients should encourage the use of **non-sugar sweeteners**, in particular xylitol, in food and drink.
- B Patients should be encouraged to use **sugar-free chewing gum**, particularly containing xylitol, when this is acceptable.
- B Clinicians should prescribe **sugar-free medicines** whenever possible and should recommend the use of sugar-free forms of non-prescription medicines.

▶ TOOTH PROTECTION

- A **Sealants** should be applied and maintained in the tooth pits / fissures of high caries-risk children.
- B The condition of sealants should be reviewed at each check-up.
- B Glass ionomer sealants should only be used when resin sealants are unsuitable.
- B **Fluoride tablets** (1 mg F daily) for daily sucking should be considered for children at high risk of decay.
- B A **fluoride varnish** (e.g. Duraphat) may be applied every four to six months to the teeth of high caries risk children.
- B **Chlorhexidine varnish** should be considered as an option for preventing caries.
- Consistent preventive messages should be reinforced by the dental practice team and by other health care professionals.

SECONDARY AND TERTIARY PREVENTION OF DENTAL CARIES

Secondary prevention: Limiting the impact of caries at an early stage

Tertiary prevention: Rehabilitation of the decayed teeth with further preventive care

▶ DIAGNOSIS OF DENTAL CARIES

- A **Bitewing radiographs** are recommended as an essential adjunct to a patient's first clinical examination.
- B The frequency of further radiographic examination should be determined by an assessment of the patient's caries risk.

Operative management of carious lesions alone cannot be relied on to prevent further disease.

Primary preventive measures must be continued.

▶ RE-RESTORATION

- B The diagnosis of secondary caries is extremely difficult and clear evidence of involvement of active disease should be ascertained before replacing a restoration.
- If only part of a restoration is judged to have failed, consideration should be given to repairing rather than replacing it.

▶ MANAGEMENT OF CARIOUS LESIONS

Occlusal caries

- A **If caries extends clinically into dentine**, carious dentine should be removed and the tooth restored.
- If only part of the fissure system is involved**, the treatment of choice is a composite sealant restoration.
- C **Dental amalgam** is an effective filling material which remains the treatment of choice in many clinical situations. There is no evidence that amalgam restorations are hazardous to general health.

Approximal caries

- A **Preventive care**, e.g. topical fluoride varnish, rather than operative care is recommended when approximal caries is confined to enamel.

Smooth surface caries

- Management of smooth surface caries (non cavitated) should be as for approximal lesions confined to the enamel.

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Derived from the national clinical guideline recommended for use in Scotland by the Scottish Intercollegiate Guidelines Network (SIGN), Royal College of Physicians of Edinburgh, 9 Queen Street, Edinburgh EH2 1JQ

Available on the SIGN website: www.sign.ac.uk