Dental Recall
Recall interval between routine dental examinations

EVIDENCE, METHODS & GUIDANCE

Update information

Minor changes since publication

September 2018: After a surveillance review some links and information have been updated. These changes can be seen in the short version of the guideline at
https://www.nice.org.uk/guidance/cg19

Contents

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Conflict of interests

The Guideline Development Group were asked to declare any possible conflict of interest and none that could interfere with their work on the guideline were declared.
All documentation is held by the National Collaborating Centre for Acute Care.

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    Assembly for Wales)

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Abbreviations used in Guideline

AIDS	Acquired Immune Deficiency Syndrome
BPE	Basic Periodontal Examination
CDS	Community Dental Service
CEA	Cost Effectiveness Analysis
COHG	Cochrane Oral Health Group
DMF	Decayed Missing Filled
DMFS	Decayed Missing Filled Surfaces
DFS	Decayed Filled Surfaces
DMFT	Decayed Missing Filled Teeth
DPB	Dental Practice Board
DT	Decayed Teeth
DS	Decayed Surfaces
EBV	Epstein Barr Virus
FGDP	General Dental Practitioners
FT	Filled Teeth
GDG	Guideline Development Group
GDS	General Dental Service
GP	General Practitioner
GPP	Good Practice Point
HIV	Human Immunodeficiency Virus
HPV	Human Papilloma Virus
HSV	Herpes Simplex Virus
HTA	Health Technology Assessment
ICD	International Classification of Diseases
NCC-AC	National Collaborating Centre for Acute Care

HEED	Health Economic Evaluations Database
NHS	National Health Service
HMIC	Health Management Information Consortium
NICE	National Institute for Clinical Excellence
NeLH	National electronic Library for Health
NHANES III	The Third National Health and Nutrition Examination Survey
NHS	National Health Service
NHS HEED	NHS Economic Evaluations Database
NZGG	New Zealand Guidelines Development Group
OFT	Office of Fair Trading
OHA	Oral Health Assessment
OHR	Oral Health Review
OR	Odds Ratio
OSMF	Oral Submucous fibrosis
PDS	Personal Dental Service
PCT	Primary Care Trusts
RCT	Randomised Control Trial
SHA	Strategic Health Authorities
SIGN	Scottish Intercollegiate Guideline Network
SIGLE	System for Information on Grey Literature in Europe
SOHSI	Subjective Oral Health Status Indicators
UK	United Kingdom
VT	Vocational Trainee

1. Introduction

1.1 **Background**

Analysis of dental attendance patterns using the Dental Practice Board's longitudinal data has demonstrated that attendance behaviour in NHS primary dental care is variable and that many patients attend less frequently than six monthly. However, six monthly dental check-ups have been customary in the General Dental Service (GDS) in the United Kingdom since the inception of the National Health Service (NHS). Although a recall interval of six months is not explicitly recommended by the NHS, current regulations implicitly recognise this practice by remunerating dental practitioners for providing six-monthly check-ups. In addition, registration with an NHS dentist lapses if the interval between check-ups is greater than 15 months (Davenport et al. 2003). [Note: there are proposals to change the current registration system from 1st October 2005].

In recent years there has been significant debate over the timing of recall intervals for dental check-ups. In the strategy document *'Modernising NHS Dentistry – Implementing the NHS Plan'* (Department of Health 2000) it was argued that a blanket six-monthly recall policy was too rigid and that patients should be recalled at intervals matching their individual needs more closely. Furthermore, the government explicitly stated its intention to examine the evidence for changing working practices *'including more flexible recall intervals for routine examinations, to ensure the most appropriate treatment and care for patients'* (Department of Health 2000). This view has been reiterated in a more recent assessment of primary care dental services by the Audit Commission, which suggested that evidence-based criteria should be introduced to determine the best check-up attendance interval for each individual patient (Audit Commission 2002).

The 'recall interval debate' has also coincided with an important period of change in the NHS dental services in England and Wales, designed to encourage these services to move towards a more preventive-oriented and clinically effective way of meeting patient needs. The strategy document "NHS Dentistry: Options for Change" (Department of Health 2002) and subsequent legislation are bringing about changes in the organisation of dental services, the remuneration of dentists and the way in which oral health is assessed. The new proposed 'gateway to NHS dentistry' is through a comprehensive Oral Health Assessment (OHA). Under the new arrangements a comprehensive Oral Health Assessment will be conducted when a patient first visits a practice and will involve taking full patient histories, carrying out thorough dental and head and neck examinations and providing initial preventive advice. The dentist and patient will discuss the findings and then agree a personalised care plan and a 'destination' for this particular journey of care. The dental team and the patient will then work through this first personal care plan (see diagram in Appendix A).

After an agreed interval the patient will return for an Oral Health Review (OHR), during which the histories and examination will be updated and any changes in risk factors noted. The dental team will also assess the effectiveness of the treatment and preventive advice provided previously, and will give more advice as necessary. The patient and dentist will discuss the findings of the review and agree the next, refined, personalised care plan and a specific 'destination' for this new journey of care (see diagram in Appendix A).

Taking into account these new arrangements and the remit and agreed Scope of this guideline, the term

Oral Health Review (OHR) is used throughout this guideline to refer to the continuing re-examination of an individual's oral health and risk status. This guideline focuses on providing guidance for clinicians on assigning recall intervals between Oral Health Reviews.

Unfortunately, there is a paucity of reliable scientific evidence in relation to this area of dental practice. A report published by the West Midlands Health Technology Assessment Collaboration (hereafter referred to as the HTA Report) systematically reviewed the effectiveness of routine dental checks of different recall frequencies in adults and children (Davenport et al. 2003). The authors found limited evidence of poor overall quality and concluded that there was no high quality evidence to either support or refute the current practice of encouraging six-monthly dental checks in children and adults. An 'update' of this review (presented in Chapter Two of this guideline) also highlights the lack of high quality research to inform clinical practice on assigning recall intervals.

Further primary research is warranted in order to assess the relative effectiveness of different recall intervals for dental check-ups. However, in the absence of such evidence, it has been suggested that the period between check-ups should be based on a professional assessment of an individual patient's risk of or from oral disease (Health Development Agency 2001).

For many years, it has been argued in the scientific literature that a risk-based assessment of an individual patient's dental history and oral health status is an important prerequisite for treatment planning and the delivery of appropriate preventive care and advice. This risk assessment is an important part of contemporary dental practice and is a process that dental professionals typically engage in every day of their working lives when examining patients, albeit in a somewhat informal and intuitive fashion. This guideline capitalises on clinicians' efforts to tailor care to meet the needs of patients by advocating the adoption of a formal risk-based procedure for determining recall intervals for individual patients at a specific point in time. In the traditions of evidence-based practice, this process incorporates the best available scientific evidence,

the individual clinical judgement and expertise of dental personnel and takes into consideration the values and expectations of patients.

The recommendations contained in this guideline are intended to assist clinicians in selecting recall intervals between Oral Health Reviews (OHRs) that are appropriate to the needs of individual patients. Patients should be informed that a single 'set' recall interval for their entire lives may not be deemed appropriate and that the recall interval may vary over time to take into account any changes in their level of risk of or from oral disease.

1.2   **What is a guideline?**

Guidelines are recommendations for the care of individuals in specific clinical conditions or circumstances – from prevention and self-care though primary and secondary care to more specialised services. Clinical guidelines are based on the best available evidence, and are produced to help health care professionals and patients make informed choices about appropriate health care. Guidelines do not replace the knowledge and skills of healthcare professionals – they complement clinical judgement with the primary objective of enhancing quality of care.

Clinical guidelines are based on the best available evidence and their development is facilitated by the availability of high quality research. However, it is often in areas where the evidence is weak or conflicting that guidance for clinicians is most needed. When the scientific evidence needed to answer key clinical questions is either of poor quality, inconsistent or non-existent, recognized methods for developing consensus can be used by guideline developers to assist in the formulation of recommendations.

Clinical guidelines for the NHS in England and Wales are produced as a response to a request from the Department of Health and the Welsh Assembly Government. They select topics for guideline development and consult with the relevant patient bodies, professional organisations and companies before deciding whether to refer a particular topic to the National Institute for Clinical Excellence (NICE) – an organisation independent of government and

the Department of Health. Once a topic is referred, NICE then commissions one of seven National Collaborating Centres to produce a guideline. The Collaborating Centres are independent of government and comprise partnerships between a variety of academic institutions, health profession bodies and patient groups. The Collaborating Centres establish a multidisciplinary Guideline Development Group (GDG) comprising health professionals, lay representatives and technical experts. The GDG assesses the evidence available on the guideline topic and makes recommendations. Consensus methods may be used by the GDG where the available evidence is of limited quantity and quality.

1.3 Remit of the Guideline

The following remit was received from the Department of Health and the Welsh Assembly Government in May 2002 as part of the Institute's 7th wave programme of work:

"To prepare guidance for the NHS in England and Wales on the clinical and cost-effectiveness of a dental recall examination for all patients at an interval based on the risk from oral disease"

The recommendations in this guideline were arrived at following careful consideration of the available evidence. Where the scientific evidence needed to answer key clinical questions was either of poor quality, inconsistent or non-existent, recognised methods for developing consensus were used.

1.4 What the guideline covers

The guideline includes recommendations for patients of all ages (both dentate and edentulous patients) and covers primary care received from NHS dental staff (dentists, independent contractors contracting within the NHS, dental hygienists and therapists) practising in England and Wales. The guideline takes into account the potential of the patient and the dental team to improve or maintain the quality of life and to reduce morbidity associated with oral and dental disease.

In arriving at recommendations, the impact of dental checks on patients' well-being, general health and preventive habits; caries incidence and avoiding restorations; periodontal health and avoiding tooth loss; and avoiding pain and anxiety have been considered.

1.5 What the guideline does not cover

This guideline does not consider recall intervals for routine scale and polish treatments. Although the provision of a scale and polish following a recall examination is common practice in primary dental care settings, the frequency of dental check-ups does not have to be directly linked to the frequency of scaling and polishing. A systematic review of this area is currently being conducted by the Cochrane Oral Health Group (COHG).

The guideline does not cover the prescription and timing of dental radiographs. Guidance on selection criteria for dental radiographs has been developed in the UK by the Faculty of General Dental Practitioners (Faculty of General Dental Practitioners 2004).

The guideline does not cover intervals between dental examinations that are not routine dental recalls; that is, intervals between examinations related to ongoing courses of treatment, or part of current dental interventions.

The guideline does not cover emergency dental interventions, or intervals between episodes of specialist care.

Finally, although this guidance is focussed at the level of the individual patient, it is important that efforts should continue to promote broader population-based strategies for preventing dental disease and improving oral health, an area outside the scope for this guideline.

1.6 Who developed the guideline?

A multidisciplinary Guideline Development Group (GDG) comprising professional group members (including several practising dentists) and consumer representatives of the main stakeholders developed this guideline (see Acknowledgements). The National Institute for Clinical Excellence funds the National Collaborating Centre for Acute Care and thus supported the development of this guideline. The GDG was convened by the National Collaborating Centre for Acute Care (NCC-AC) and Chaired by Professor Nigel Pitts. In accordance with the NICE

guideline development process (National Institute for Clinical Excellence 2001), all guideline development group members have made and updated any declarations of interest. The Group met on a monthly basis during development of the guideline.

Staff from the NCC-AC, the COHG (Manchester), and the Oral Health Services Research Centre (University College Cork, Ireland) provided methodological support and guidance for the development process, undertook systematic searches, retrieval and appraisal of the evidence and drafted the guideline. Staff were also assisted by the Director of the International Centre for Evidence-Based Periodontal Health at the Eastman Dental Institute, University College London.

The Glossary to the guideline contains definitions of terms used by staff and the GDG.

1.7   Guideline Methodology

1.7.1   Outline of methods used

There were several steps involved in the development of these guidelines:

> **Systematic review of the literature – to 'update' the previous Health Technology Assessment review on the clinical effectiveness and cost-effectiveness of routine dental checks (Davenport et al. 2003)**

> **Review of background literature relating to oral diseases, patient views and the effectiveness of oral health promotion. Modelling of cost-effectiveness of different recall intervals**

> **Use of formal and informal consensus methods for a variety of tasks, including clarifying questions addressed by the guideline and making guideline recommendations**

> **The Guideline Development Group found that the scientific evidence in relation to many aspects of dental recall intervals was weak and conflicting. However, there was evidence relating to risk factors for oral disease and evidence on the effectiveness of dental health education and oral health promotion that was used to inform the guideline recommendations.**

1.7.2   Questions addressed in developing the guideline

The GDG established that, for the purposes of developing the guideline, two groups of questions would need to be examined: key clinical questions specifying the populations, interventions, comparisons and outcomes of interest; and background and epidemiology questions including: rate of progression of oral diseases, advice and preventive measures against oral diseases and patient views and expectations of their dentist and dental treatment. Please see Appendix B for a full list of these questions.

KEY CLINICAL QUESTIONS

In relation to the key clinical questions, an update of the HTA Report was undertaken. The aim of this update was to review any additional evidence published between February 2001 (the date of completion of the HTA search) and July 2003 (the date of completion of NCC-AC search) judged to be of relevance in addressing the original questions posed in the HTA review, namely:

(a) How effective are routine dental checks of different recall frequencies in improving quality of life and reducing the morbidity associated with dental caries and periodontal disease in children?

(b) How effective are routine dental checks of different recall frequencies in improving quality of life, reducing the morbidity associated with dental caries, periodontal disease and oral cancer, and reducing the mortality associated with oral cancer in adults?

The updated review sought to replicate the methods adopted in the original HTA review. In this context, similar study populations, interventions, comparators and outcomes of interest were specified.

1.7.3 **Systematic Review Methods for Key Clinical Questions**

TYPES OF STUDY POPULATION

The populations considered (in both the HTA Report and our updated review) were children and adults. These populations were further sub-divided according to dentition type: deciduous dentition, mixed dentition, permanent dentition and edentulous. The updated review explicitly recognised edentulous patients as a population category.

TYPES OF INTERVENTIONS

The intervention considered was a 'routine dental check' as defined in the NHS General Dental Service Statement of Remuneration: "Clinical examination, advice charting (including monitoring of periodontal status) and report." In practice it proved impossible to apply the intervention inclusion criteria (in both the HTA Report and our updated reviews) as no identified publications provided sufficient detail about the intervention under study. Studies were therefore included if the intervention was termed a 'dental check,' a 'dental examination,' a 'dental visit' or a 'dental attendance.' In describing the results of this updated review the term 'dental check' has been used throughout to embrace these different terms.

TYPES OF COMPARATORS

The comparator was 'no routine dental check' (as defined above) or routine dental check of different frequency.

TYPES OF OUTCOMES

The outcomes of interest were divided into:

> Primary Outcomes: Caries, periodontal disease, oral cancer and quality of life

> Secondary Outcomes: Mucosal lesions, behaviour change, need for orthodontic treatment.

In the updated review, erosion and tooth surface loss were included as secondary outcomes of interest. However, we found no relevant studies that reported these particular outcome measures.

TYPES OF STUDIES

There was no restriction on study design and all observational epidemiological study designs were included.

LITERATURE SEARCH

The literature review for our guideline was designed to find references published since the completion of searching for the HTA Report in February 2001. The search terms used in the HTA Report and some additional key words were used to form the basis of the search strategy. Search filters for systematic reviews, randomised controlled trials and other observational studies were combined with this to retrieve quality studies. No language restrictions were applied to the search. The search strategies of the following databases are included in Appendix C.

> Medline (Ovid) 2001 – 17 July 2003

> Embase (Ovid) 2001 – week 29 2003

> The Cochrane Library 2001 up to Issue 3, 2003

We searched the System for Information on Grey Literature in Europe (SIGLE) and Health Management Information Consortium (HMIC) for reports, and we searched for guidelines and consensus documents on the guideline web sites listed below. Bibliographies of identified reports and guidelines were also checked to identify relevant literature.

> Canadian Medical Association Infobase (http://mdm.ca/cpgsnew/cpgs/)

> National Institute of Clinical Excellence (NICE) (http://www.nice.org.uk)

> National electronic Library for Health (NeLH) (http://www.nelh.nhs.uk/)

> National Institutes of Health Consensus Development Program (http://www.consensus.nih.gov)

> New Zealand Guidelines Development Group (NZGG) (http://www.nzgg.org.nz/)

> Scottish Intercollegiate Guideline Network (SIGN) (http://www.sign.ac.uk)

> US National Guideline Clearing House (http://www.guidelines.gov)

SELECTING STUDIES

Two reviewers independently scanned the titles and abstracts of the observational studies in order to identify potentially relevant studies. They excluded papers that were considered definitely irrelevant. We obtained full publications for any studies identified by one or both reviewers as being of potential relevance to the review or where there was insufficient information from the title and abstract to make a decision. Two reviewers applied the inclusion criteria to all potentially relevant studies and any disagreements were resolved by discussion. No formal analysis of agreement between the reviewers was performed.

DATA EXTRACTION

One reviewer carried out the data extraction process. Data extracted from each study regarding the patient population, intervention, comparators and outcomes were used to construct two summary tables: a 'Key Study Characteristics' table and an 'Effectiveness table' (Appendix D).

QUALITY ASSESSMENT

Two reviewers carried out the quality assessment of eligible studies using similar appraisal checklists to those used in the HTA Report (Davenport et al. 2003). The checklists were specific to study design with a view to capturing design-specific biases. Attempts to control for selection biases through adjustment for potential confounders were assessed.

As this guideline is intended to inform practice in the NHS in England and Wales, the external validity of the results of studies carried out in settings other than the UK was also considered as part of the assessment.

1.7.4 Hierarchy of evidence

There are many different methods of ranking the evidence and there has been considerable debate about what system is best. A number of initiatives are currently under way to find an international consensus on the subject, but until a decision is reached on the most appropriate system, for the NICE guidelines the Institute advises the National Collaborating Centres to use the system for evidence shown in Table 1.

TABLE 1: Levels of evidence for intervention studies*	
LEVEL OF EVIDENCE	TYPE OF EVIDENCE
1++	High-quality meta-analyses, systematic reviews of 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, bias or chance and a high probability that the relationship is causal
2+	Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal
2-	Case-control or cohort studies with a high risk of confounding bias or chance and a significant risk that the relationship is not causal
3	Non-analytic studies (for example, case reports, case series)
4	Expert opinion, formal consensus

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1.7.5 Health economics methods

It is important to investigate whether dental health services are clinically effective and also cost-effective (that is, provide value for money). If, hypothetically, frequent Oral Health Reviews (OHRs) were found to yield little health gain, relative to the resources used, then we would be better off by having less frequent

OHRs and re-deploying resources to other activities that yield greater health gain.

LITERATURE REVIEW

We obtained published economic evidence on different recall intervals for OHR from a systematic search of the following databases:

> Medline (Ovid) (2001-2003)

> Embase (2001-2003)

> Health Economic Evaluations Database (HEED)

> NHS Economic Evaluations Database (NHS EED)

We also identified and reviewed relevant references in the bibliographies of reviewed papers including those from the HTA Report. We did not conduct original searches of Medline and Embase prior to 2001 as this would duplicate the systematic searches of the HTA Report.

The strategy was designed to find any applied economic study related to different dental recall intervals. The health economist reviewed abstracts and database reviews of papers, and discarded those that appeared not to contain any original data on cost or cost-effectiveness and where the analysis was not incremental (and was not described adequately to allow incremental analysis).

COST-EFFECTIVENESS MODELLING

The cost-effectiveness analysis contained in the HTA Report was the most relevant to this guideline because it estimated both incremental cost and incremental health gain for a number of different recall intervals from a UK NHS perspective. The model represented a promising start to research in this area, but it did have three major limitations:

> the report does not state what assumptions/ data were used in the model that would lead to oral health being greater with narrower recall intervals

> it considered only dental caries prevention and no other aspects of oral health

> the outcome used for health gain in dental caries prevention (in the model for adults it was number of DMFT-free teeth at age 80) was not ideal.

On the basis of this guideline's systematic review a modified model was constructed that would improve on limitations one and three. However, the incorporation of other aspects of oral health (limitation two) was not possible because of the lack of suitable data and also the absence of an overall measure of health outcome.

1.7.6 **Forming and grading the recommendations**
NICE guideline recommendations are graded according to the strength of the supporting evidence, which is assessed from the design of each study (see Table 1). The grading system currently used is presented in Table 2.

The Guideline Development Group was presented with the summaries (text and evidence tables) of the best available research evidence to answer their questions. Recommendations were based on, and explicitly linked to, the evidence that supported them.

The Group worked, where possible, on an informal consensus basis. Formal consensus methods (modified Delphi techniques or nominal group technique) were employed if required (for example, agreeing recommendations and audit criteria). The recommendations were then graded according to the level of evidence upon which they were based.

TABLE 2: Grading of recommendations**

GRADE	EVIDENCE
A	> At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population, or
	> A systematic review of RCTs or 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, or
	> 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, or
	> Extrapolated evidence from studies rated as 2++
D	> Evidence level 3 or 4, or
	> Extrapolated evidence from studies rated as 2+, or
	> Formal consensus
(GPP)	A good practice point (GPP) is a recommendation for best practice based on the clinical experience of the Guideline Development Group

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2. Clinical effectiveness and cost-effectiveness of routine dental checks (HTA update)

In order to inform the guideline development process, the GDG decided that it was essential to identify and assess systematically the evidence for the clinical effectiveness of routine dental checks of different recall frequencies. As a systematic review addressing this issue had recently been carried out and published as a Health Technology Assessment (HTA) Report (Davenport et al. 2003), it was decided that an 'update' of this Report should be undertaken. The aim of this exercise was to review any additional evidence published since the date of completion of the HTA search judged to be of relevance in addressing the original clinical effectiveness questions posed in the HTA Report, namely:

How effective are routine dental checks of different recall frequencies in improving quality of life and reducing the morbidity associated with dental caries and periodontal disease in children?

How effective are routine dental checks of different recall frequencies in improving quality of life, reducing the morbidity associated with dental caries, periodontal disease and oral cancer, and reducing the mortality associated with oral cancer in adults?

The updated review sought to replicate the methods adopted in the HTA Report. In this context, similar study populations, interventions, comparators and outcomes of interest were specified. The methods used are described in chapter one.

2.1 Characteristics of the Included Studies

2.1.1 Characteristics of the study settings and study design

See Appendix D for further details.

Thirteen studies were included in our updated review. Of these, there were three cohort/longitudinal studies (Chavers et al. 2002; Locker 2001; Thomson 2001), two case-control studies (Bullock et al. 2001; Lissowska et al. 2003), seven cross-sectional studies (Boehmer et al. 2001; Campus et al. 2001; Carvalho et al. 2001; Freire et al. 2002; Petersen et al. 2001; Ugur et al. 2002; Ullah et al. 2002) and one study that was described by the authors as a 'case study,' based on consecutive patients' responses to a dental health questionnaire administered over a six month period (Richards et al. 2002).

The included studies were conducted in a variety of different populations and settings. Only two studies (Bullock et al. 2001; Richards et al. 2002) were conducted in general dental practice settings in England and Wales. One of these studies (Bullock et al. 2001) was conducted in a mixed private/NHS practice in Stoke-on-Trent, North Staffordshire. The other study (Richards et al. 2002) was conducted in a general dental practice in an urban area of Swansea, South Wales.

Of the remaining studies, four were conducted in European countries (Campus et al. 2001; Carvalho et al. 2001; Lissowska et al. 2003; Ugur et al. 2002), two in the United States (Boehmer et al. 2001; Chavers et al. 2002), one in Brazil (Freire et al. 2002), one in Canada (Locker 2001), one in Southern Thailand (Petersen et al. 2001), one in

New Zealand (Thomson 2001) and one in Bangladesh (Ullah et al. 2002).

Ten studies used a 'subjective' measure of dental check frequency and relied on reported attendance by participants, obtained either from self-administered questionnaires, questionnaires completed by parents/guardians or structured interviews (Boehmer et al. 2001, Campus et al. 2001, Carvalho et al. 2001, Chavers et al. 2002, Freire et al. 2002, Lissowska et al. 2003, Petersen et al. 2001, Thomson 2001, Ugur et al. 2002, Ullah et al. 2001). Only three studies used an 'objective' measure of dental check frequency and directly consulted clinical records to provide evidence of frequency of dental checks or gleaned information on patients' attendance patterns from their dentists (Bullock et al. 2001; Locker 2001; Richards et al. 2002).

2.1.2   Characteristics of the Participants
See Appendix D for further details.

The effects of dental check frequency were examined in a diverse range of age groups. The most common age group considered was 12-year olds, who formed the study population in four studies (Campus et al. 2001; Carvalho et al. 2001; Petersen et al. 2001; Ullah et al. 2002). In the remaining studies the

participants varied in age from 13 (Ugur et al. 2002) to 80 (Lissowska et al. 2003) years. All the studies found looked at people with permanent dentition.

Access to dental care for the population under investigation was not stated in eight studies (Boehmer et al. 2001; Chavers et al. 2002; Freire et al. 2002; Lissowska et al. 2003; Locker 2001; Petersen et al. 2001; Ugur et al. 2002; Ullah et al. 2002). In only two studies (Bullock et al. 2001; Richards et al. 2002) could the participants and settings be assumed to be representative of the population groups and health care settings covered by this guideline. In both studies, participants were recruited opportunistically as they presented themselves at general dental practices. In the remaining studies where access was described (Campus et al. 2001; Carvalho et al. 2001; Thomson 2001), the dental health-care system was not comparable with that in England and Wales.

2.1.3   Characteristics of the Intervention and Comparisons
There was little information included in the studies on what a 'dental check' actually entailed (or could be presumed to entail). In most studies it was not clear whether the relationship between frequency of dental checks or frequency of dental treatment

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TABLE 3: Comparisons between 'regular' and 'irregular' attenders made in selected studies from the 'updated' HTA review

STUDY ID	"REGULAR ATTENDERS"	"IRREGULAR ATTENDERS"
Bullock and co-workers, 2001	Attended for at least two dental examinations in past two years ('regular attender')	No dental attendance in past two years and who had attended in response to a dental problem ('casual attender')
Chavers and co-workers, 2002	Respondent described approach to dental care as "I go to a dentist occasionally, whether or not I have a problem" or "I go to a dentist regularly"	Respondent described approach to dental care as "I never go to a dentist" or "I go to a dentist when I have a problem or I know I need to get something fixed"
Richards and Ameen, 2002	Last attendance within the last two years	Last attendance more than two years ago
Ugur and Gaengler, 2002	Respondents reported regular visits every year to have their teeth examined	Respondents reported only going to the dentist if there was a 'tooth problem'
Ullah and co-workers, 2002	Respondent reported visiting the dentist more than once a year	Respondent reported visiting the dentist less than once a year

and/or dental checks and oral health outcomes was being investigated. Where 'dental visiting' or 'dental attendance' patterns were being studied it proved impossible to distinguish between prevention oriented/motivated visits (for asymptomatic check-up) and treatment oriented/motivated visits for a specific problem, infection etc.

There was a diverse range of comparisons made in the included studies. The most common comparison made in studies was between the oral health status of 'regular' and 'irregular' attenders. However, different studies used different definitions of what was deemed to be 'regular' or 'irregular' attendance. The diversity of some of these definitions are illustrated in Table 3 opposite.

The 'irregular' category was thus used to encapsulate 'casual' or 'problem-oriented attenders.' The differing definitions of regular and irregular attendance used in the studies constituted another source of heterogeneity making comparisons between studies difficult.

See Appendix D for details of the comparisons made in the remaining included studies.

2.1.4   Outcomes

The 13 studies reported a diversity of clinical status outcomes for dental caries, periodontal disease and oral cancer, including: mean number of teeth present, mean DMFS (Decayed Missing Filled Surfaces), mean DFS (Decayed Filled Surfaces) increment, mean DMFT (Decayed Missing Filled Teeth), decayed coronal surfaces, root caries, caries severity, dentinal caries on bitewing radiography, visual caries causing cavitation, periodontal treatment need, presence or absence of mobile teeth, oral hygiene, mean number of periodontally involved teeth, plaque scores, mucosa scores, oral cavity and pharynx cancer. Three studies used oral health related quality of life outcome measures (Chavers et al. 2002; Locker 2001; Richards et al. 2002).

Although a number of studies used the same outcome measures, because of poor reporting, it could not be assumed that the diagnostic criteria used in the studies were the same. The majority of studies reported outcomes in terms of mean changes in measures. A minority of studies reported changes in the proportion or number of individuals exhibiting a certain outcome.

2.1.5   Quality Assessment

We assessed the 13 included studies for internal and external validity. There was a preponderance of cross-sectional studies included in the updated review that are particularly susceptible to selection biases and confounding. The quality assessment of all studies focused on various potential sources of bias, specifically selection bias, performance bias, attrition bias and measurement bias. All of the included studies were judged as having some threat to validity.

2.1.6   Data synthesis and analysis

We deemed quantitative pooling as inappropriate due to the considerable methodological and clinical heterogeneity of the 13 studies included in this updated review. The problems with defining the intervention, the range of dental check frequencies studied, the diverse comparisons made and the range of outcome measures used, precluded the provision of anything other than a narrative summary of the findings. No sensitivity analysis was undertaken in this updated review.

2.2   Results

In order to interpret the results of this updated review, the included studies must be considered in the context of the 28 studies included in the HTA Report (Davenport et al. 2003). In the sections that follow, the results of the HTA Report are first summarised narratively, the results of the updated review are then presented and a brief commentary is added as to whether the latter results have any impact on the conclusions of the former. The updated review only found studies concerning permanent teeth, consequently, the results are compared with the HTA Report results for permanent teeth only. Due to the considerable study heterogeneity, emphasis has been placed on the consistency of the direction of outcome of study results. There are obvious limitations associated with presenting the results of studies in this manner. In particular, it fails to reflect important differences between studies such as the different frequencies being compared for each single outcome and does not take into account salient aspects of study design.

Nevertheless, such an approach can be used to summarise results of a group of observational studies and gives some indication (albeit a crude indication) of the consistency or lack of consistency of results.

Where the term 'significant' has been used in the following passages, it pertains only to the question of statistical significance and does not allude to the clinical significance or otherwise of the findings.

2.2.1 Outcome Measure: Number of teeth present

RESULTS OF THE ORIGINAL HTA REPORT

Sixteen studies investigated the relationship between dental check frequency and number of teeth present. No study reported an increase in the number of teeth with a decrease in dental check frequency. Twelve studies reported a decrease in the number of teeth with a decrease in dental check frequency (eight of which were significant differences), one study reported an increase in the number of individuals who became edentulous over a 10 year follow up period but the result was of uncertain statistical significance and three studies reported no significant difference between the number of teeth/surfaces and frequency of dental checks. (The term 'uncertain statistical significance' was used in the HTA Report where tests of statistical significance were not performed in individual studies and could not be calculated from available data.)

RESULTS OF UPDATED REVIEW

The three studies reporting the mean number of teeth present demonstrated no consistency in the direction of outcomes. One study (Boehmer et al. 2001) reported a significant decrease in the number of teeth with a decrease in dental check frequency. One study (Bullock et al. 2001) reported no difference in the number of teeth present according to dental check frequency. One study (Richards et al. 2002) reported a significant increase in the number of teeth with a decrease in dental check frequency.

These studies, when considered in the context of the results of the HTA review, do not impact on the overall consistency of findings, namely that there was generally a decrease in the number of teeth present

with a decrease in dental check frequency (Davenport et al. 2003).

2.2.2 Outcome Measure: DMFT/DMFS

RESULTS OF THE ORIGINAL HTA REPORT

Eleven studies investigating the relationship between dental check frequency and DMFT reported inconsistent findings. Two studies reported a significant increase in DMFT or DMFS with a decrease in dental check frequency. Four reported a decrease in DMFT with a decrease in dental check frequency (two of which were significant differences) and two were of uncertain significance. Five studies reported no significant difference between DMFT and frequency of dental attendance.

RESULTS OF UPDATED REVIEW

One study (Campus et al. 2001) reported no significant difference in DMFS scores according to dental check frequency (see list above for comparisons made), while another (Carvalho et al. 2001) reported a significant increase in mean DMFS score in symptomatic (appointment on pain) versus asymptomatic attenders. The latter study reported no significant differences between those who reported a control visit once a year versus those who did not report a control visit once a year.

Petersen and co-workers reported a significant increase in mean DMFT in those who reported an annual dental visit versus those who reported no annual dental visit (Petersen et al. 2001), while Thomson reported that problem-oriented attenders had significantly higher mean DMFS and DFS increment scores compared with those who attended for a check-up (Thomson 2001).

Finally, one study reported no significant difference in mean DMFT comparing regular (more than once a year) versus irregular (less than once a year) attenders (Ullah et al. 2002). However, those who attended a dentist either regularly or irregularly, had significantly higher mean DMFT scores compared with those who reported never having attended a dentist.

2.2.3 Outcome Measure: Decayed Teeth (DT)/ Decayed Surfaces (DS)

RESULTS OF THE ORIGINAL HTA REPORT

Fifteen studies investigated the relationship between dental check frequency and decay. Twelve reported an increase in decay with a decrease in dental check frequency (eight of which were significant differences and four of which were of uncertain significance). Two studies reported no significant difference between decay and frequency of dental checks. One study reported a significant association between dental check frequency and decay but the direction of the relationship was not given.

RESULTS OF UPDATED REVIEW: DENTAL CARIES

There was no consistency in the direction of outcomes in the four studies using these outcome measures.

One study reported no significant difference in the mean number of decayed coronal surfaces (comparing those who attended during last year with those who attended between one and two years ago) (Boehmer et al. 2001). However, both of the latter groups had significantly fewer decayed coronal surfaces compared with those who reported a last visit as two or more years ago.

One study reported no significant difference in the mean number of decayed surfaces according to dental check frequency across the four dental check frequency groups compared (Campus et al. 2001) (Appendix D for details of comparisons made) whilst another study reported a significant increase in the number of decayed teeth with a decrease in the dental check frequency (Ugur et al. 2002).

One study reported no significant differences in the mean number of decayed teeth between regular and irregular attenders (Ullah et al. 2002). However, those who reported attending either regularly or irregularly had significantly more decayed teeth compared to whose who never attended a dentist (see Table 3 above for definitions of 'regular' and 'irregular' used in this study).

2.2.4 Outcome Measure: Filled Teeth (FT)

RESULTS OF THE ORIGINAL HTA REPORT

The studies investigating the relationship between dental check frequency and filled teeth reported inconsistent findings. Six studies reported a decrease in filled teeth/surfaces with a decrease in dental check frequency of which five out of six were significant differences. Three studies reported no significant difference between filled teeth/surfaces and frequency of dental checks.

RESULTS OF UPDATED REVIEW

One study reported no significant difference in the mean number of filled surfaces in the four dental check frequency groups compared (Campus et al. 2001) (see Appendix D for details of comparisons made), while another reported that irregular attenders had significantly fewer filled teeth when compared with regular attenders (Ugur et al. 2002) (see Table 3 for definitions of 'regular' and 'irregular').

2.2.5 Other caries outcome measures used in our updated review

ROOT CARIES

One study reported significantly fewer untreated root caries lesions in those who reported attending the dentist during the last year compared with those who attended between one and two years ago and two or more years ago (Boehmer et al. 2001).

There were no significant differences in the mean number of untreated plus filled root caries lesions according to dental check frequency.

MISSING TEETH

One study found a significantly higher proportion of 'problem-oriented attenders' had more than one missing tooth due to caries by age 26 compared with 'routine attenders' (Thomson 2001) (see 'Appendix D for details of comparisons made). Similarly, Ugur and Gaengler reported significantly fewer missing teeth in regular attenders compared with irregular attenders (Ugur et al. 2002).

VISUAL CARIES CAUSING CAVITATION

One case-control study, comparing regular attenders with casual attenders, reported a significant increase in the proportion of subjects with visual caries causing cavitation with a decrease in dental check frequency (Bullock et al. 2001). The same study reported a significant increase in the proportion of subjects with dentinal caries on bite-wing radiographs with a decrease in dental check frequency. These differences persisted after adjusting for age, gender, social class and smoking.

CARIES SEVERITY

One study reported an increased risk of having a high caries severity among those who attended the dentist mainly when in trouble compared with those attending mainly for check-ups (Freire et al. 2002). Adolescents who reported never being to the dentist had a lower risk of high caries severity compared with those attending mainly for check-ups, although the numbers reporting no dental visits was very small.

Considering all dental caries outcomes included in the updated review in the context of the original HTA Report findings, there is no consistency in the direction of outcomes and no meaningful inferences can be drawn from the available data.

2.2.6   Periodontal Disease Outcomes

RESULTS OF THE ORIGINAL HTA REPORT

Nine observational studies investigated the relationship between dental check frequency and periodontal disease in the permanent dentition. The main findings are as follows:

Three studies investigating the relationship between dental check frequency and bleeding reported no consistency in the direction of outcomes. One study investigated the relationship between attachment level and dental check frequency and reported a significant decrease in the proportion of individuals with an attachment level of >3mm with an overall decrease in dental check frequency. Six studies investigated the relationship between probing depth/pockets and dental check frequency and reported no consistency in the direction of outcomes.

Three studies investigated the relationship between plaque or calculus and dental check frequency and reported no consistency in the direction of outcomes. Two studies investigated the relationship between bone score and dental check frequency and reported no consistency in the direction of outcomes. Three studies investigated the relationship between the presence of gingivitis and frequency of dental checks and reported no consistency in the direction of outcomes. Three studies investigated the relationship between dental check frequency and periodontal health (the absence of gingivitis, periodontitis and calculus) and reported no consistency in the direction of outcomes.

RESULTS OF OUR UPDATED REVIEW

One study reported a significantly increased mean periodontal treatment need for those who reported time since last dental visit as between one to two years ago, when compared with those who reported a visit during the last year (Boehmer et al. 2001). No significant difference in periodontal treatment need was found in this study when comparing those who reported their last dental visit between one and two years ago and those who reported that their last visit was two or more years ago.

Bullock and co-workers reported that a significantly greater proportion of casual attenders had >30% tooth bone loss and mobile teeth compared with regular attenders (see Table 3.1 above for definitions of 'regular' and 'casual') (Bullock et al. 2001) while Thomson reported a significant increase in mean plaque score in problem attenders versus those who reported that their usual reason for attending the dentist was for a check-up (Thomson 2001). One study reported that irregular attenders had significantly more periodontally involved teeth compared with regular attenders (Ugur et al. 2002).

Two studies, using different measures of periodontal disease, found no difference in outcomes with varying dental check frequency (Campus et al. 2001; Ullah et al. 2002).

In the updated review a number of studies used different outcomes to those included in the original HTA review. There was no consistency in the direction of outcomes.

Considering these results in the context of the original results of the HTA review does not alter the principal finding of the latter, namely that the results of studies investigating the relationship between dental check frequency and measures of periodontal disease in permanent dentition provide conflicting results.

2.2.7   Oral Cancer

RESULTS OF THE ORIGINAL HTA REPORT

One study demonstrated a significant relationship between time since last dental check and tumour size at diagnosis, but it remained unclear whether there was a consistent (or linear) trend in outcome with decreasing dental check frequency. One study found no significant relationship between the presence or absence of a cancerous or potentially malignant lesion at examination and time since last dental check (< or = 12 months to >12 months).

RESULTS OF THE UPDATED REVIEW

One case control study found a significant association of risk with frequency of dental check-ups (Lissowska et al. 2003). Subjects who never had dental check-ups had an oral cancer risk almost 12 times elevated (Odds Ratio (OR) 11.89) compared with subjects visiting a dentist at least every year for a check-up. There was a wide confidence interval reported around this estimate (3.33 – 42.51). The reported Odds Ratios and confidence intervals for a) subjects who attended for a dental check every two-five years and b) subjects who attended for a dental check less than once every 5 years were 1.94 (0.7 – 5.34) and 4.67 (1.56 – 14.01) respectively. The odds of oral cancer thus increased as the frequency of dental check-ups decreased.

2.2.8   Quality of Life

RESULTS OF THE ORIGINAL HTA REPORT

One study investigated the relationship between dental check frequency and quality of life. No significant relationship was demonstrated between frequency of dental checks and a perception that oral health negatively affects quality of life. A significant relationship was demonstrated between increased frequency of dental checks and a perception that oral health positively affects quality of life, and between increased frequency of dental checks and a perception that oral health positively or negatively affects quality of life. However, there were no studies identified linking empirical measures of quality of life associated with oral health and dental check frequency.

RESULTS OF THE UPDATED REVIEW

In our update, we identified three studies all using different measures of quality of life as it pertains to oral health ('oral disadvantage,' 'oral health self-rating' and 'subjective oral health status indicators'. In one study it was reported that those making one or more dental visits over the three year period of the study were more likely to report that their oral health had improved when compared with those making no visits ('oral health self-rating') (Locker 2001). In another study, Richards and Ameen reported that 'regular attenders' had significantly improved oral health related quality of life (measure of oral health derived from the Subjective Oral Health Status Indicators (SOHSI) compared with 'irregular attenders' (Richards et al. 2002). In the final study regular attenders reported significantly lower rates of oral disadvantage due to disease/tissue damage and function compared with irregular attenders (Chavers et al. 2002). There was no significant difference in oral disadvantage due to pain between regular and irregular attenders.

2.3   Cost-effectiveness

A health economist identified and reviewed a total of 351 abstracts. Sixty papers were ordered and five economic studies on different recall intervals for OHR were selected (Davenport et al. 2003; Dawson et al. 1992; Lunder 1994; Wang et al. 1992; Wang et al. 1995). Four of these studies were reviewed in the HTA Report and the other was an economic model developed for the HTA Report itself.

The model reported in the HTA Report (Davenport et al. 2003) was unique in each of the following respects:

> **It explicitly evaluated a range of different recall intervals**

> **It was an incremental cost-effectiveness analysis (it estimated *both* health gain and resource cost for each recall interval)**

> **It had a UK NHS setting and considered a broad range of patients.**

The other studies analysed resource implications of various intervals for dental check-ups. Table 4 and Table 5 show the methodological summaries and results of these studies.

2.3.1 The HTA Report model

The HTA Report model aimed to assess the cost-effectiveness of 3, 6, 12, 18, 24 and 36 monthly routine dental checks. Cohort simulations (Markov models) were constructed to estimate for each recall interval:

> The total cost of OHRs and the cost associated with the treatment of decay (filling deciduous and permanent dentition) per patient

> and number of teeth free from decay, extraction or fillings for deciduous teeth (dmft) and permanent teeth (DMFT).

Separate models were constructed for a cohort between the ages of one and six and for another cohort between the ages of 12 and 80. Separate analyses were undertaken for different risk subgroups according to socio-economic background (manual versus non-manual) and water fluoridation. For each risk group, the outcome of the model was cost per tooth free from decay, fillings or extraction at the end of the model simulation.

They defined the risk factor group manual/nonfluoridated as the base case. For the base case analysis, the rate of progression of decay experience (from DMF-free to DMF) is 0.3 teeth per year in deciduous dentition and 0.37 teeth per year in permanent dentition. Caries progression was assumed to be 14.6% lower in fluoridated areas and 20.7% lower for non-manual socio-economic groups.

They found that, as the recall interval decreases, overall costs are increased but there are more DMF-free teeth. The increased effectiveness was highest in non-fluoridated and manual socio-economic classes. As recall intervals moved step by step from 36 months to three months the incremental cost per additional dmf-free tooth gained became greater and greater. Moving from six months to three months intervals was considered to be not cost-effective, however given that the threshold of cost per DMF-free tooth is not known, such a conclusion is largely

conjecture. The results were not sensitive to changes in hazard rate and restoration survival rate. However, not all model parameters were tested in the sensitivity analysis – the biggest omission being the clinical effectiveness of dental check-ups, an assumption that was not made explicit in the report.

The model had the following limitations:

> **The report incorporated only dental caries and not periodontal diseases and mucosal abnormalities. (Patients with mixed-dentition and edentate patients were also omitted. Different risk factors other than social class and water fluoridation were not taken into account).**

> **The assumptions about the effectiveness of dental check-ups were not explicit, (that is, no mention was made of sensitivity and specificity of dentists' identifying enamel caries nor of the effectiveness of prevention).**

> **The outcome measure DMFT at the end of the model simulation does not fully incorporate the health gain associated with caries prevention and treatment.**

> **The calculation of the cost of treatment was restricted to the cost of OHR and fillings. The cost of radiography, scaling and polishing, extractions, crowns, bridges, etc. were not included.**

> **Although, the model suggests that reduced dental recall intervals are not good value for money, the outcome measure chosen does not allow comparison with a standard threshold or with other studies. Hence, it can't be concluded which interval is optimal in terms of cost-effectiveness.**

2.3.2 Other studies

One cost analysis (Dawson et al. 1992) and three resource impact analyses (Lunder 1994; Wang et al. 1992; Wang et al. 1995) were selected for tabulation (Table 4 andTable 5). All four had been reported in the HTA Report.

According to the results of Dawson and Smales (Dawson et al. 1992), extending recall intervals reduced the number of restorations received and

restoration survival but these results were not statistically significant. The other three studies suggested that extending recall intervals could save some resources through reduction in dentist's time but may have an adverse effect on the level of dental health (measured in terms of DMFS) (Lunder 1994; Wang et al. 1992; Wang et al. 1995).

These studies may not be generalisable because:

> **The main focus of these studies was on children or military personnel.**

> **The studies were set in locations with different oral health systems and different levels of oral hygiene and oral health. We would expect the impact of dental recall intervals on the number of restorations to be influenced by the oral health system. For example, in systems where dentists receive a fee per restoration and where these fees are set at a relatively high level, the incentives are such that we could see the number of restorations increasing with narrower recall intervals – a phenomenon known as 'supplier induced demand'.**

> **The studies had relatively short periods of observation (from 2 years to 10 years) and variable sample size (from 46 to 2750).**

> **The measure of the impact of change in recall intervals on dental health is restricted to DMFS/DMFT or decline in number of new decayed teeth. This would not capture all of the health gain attributable to the OHR.**

2.4 Conclusions

The studies included in this updated review are methodologically and clinically heterogenous, restricting comparisons between studies and limiting generalisability to the UK context. All studies were judged to have some threat to validity and a major limitation of a number of studies was the method used to measure the frequency of the intervention. The majority of studies used a subjective measure of dental check frequency, which compromised the validity of the data collected. It is reasonable to assume that attendance frequency is 'over-estimated' in questionnaire/interview type surveys and there is some empirical evidence to support this assumption.

Due to the study designs employed it is impossible to determine whether observed differences between comparison groups are due to differences in the frequency of provision of the intervention (dental check) or whether these differences can be attributed to the presence of other known or unknown potential confounding factors not controlled for in the analysis.

Overall, there was no consistency observed across studies in the direction of effect of different dental check frequencies on measures of caries and periodontal disease. There appears to be some weak evidence from three studies that regular attendance is associated with improved quality of life as it pertains to oral health. Due to the heterogeneity of populations, interventions, comparisons and outcome measures used in these studies, this finding should be interpreted cautiously.

There were no economic comparisons of dental recall intervals published since the HTA report. Those studies that were included in the HTA report were based on specific populations and were not based on rigorously controlled trials. The model that was developed for the HTA report itself was the only study to compare costs and health outcomes for a number of different recall intervals in a UK context but it too had major limitations (referred to previously in this chapter).

Considered in the context of the HTA Report, the results of this updated review fail to alter the conclusions of the original review:

> **There is little evidence to either support or refute the practice of encouraging 6 monthly dental checks in adults or children**

> **There is little evidence to suggest an optimal dental check frequency for any of the outcomes considered**

> **There remains uncertainty in how patients value their oral health**

> **Further primary research is needed in order to assess the relative clinical effectiveness and cost-effectiveness of different frequencies of dental check in terms of impact on caries, periodontal disease, oral cancer and quality of life.**

TABLE 4: Oral Health Review Economics Papers – Characteristics of Studies

Study	Comparison	Target group	Type of the study	Effectiveness measure	Cost/resource	Method
Davenport et al., 2003, UK	3 , 6, 12, 18, 24, 36 months	1-6 years of age with only deciduous dentition, 12-80 years of age with only permanent dentition according to: – manual/non-fluoridated – manual-fluoridated – non-manual/non-fluoridated – non-manual/fluoridated	Markov Decision Analysis	Number of teeth free from decay, extraction or fillings for deciduous (dmft) and permanent (DMFT)	Average cost of OHR and cost associated with the treatment of decay (filling deciduous and permanent dentition)	Cost Effectiveness Analysis (CEA)
Dawson and Smales, 1992, Australia	6 vs. 12 months	Aircrew (n=24) and Groundcrew (n=76) from Australian defence force	10 year Retrospective	Average number of restorations and Restoration survival	Average cost of treatment + examination	Cost Impact Analysis
Wang et al., 1992, Norway	12 vs. 24 months	185 children, **3-5 year old** 12 months (n=27) 24 months (n=31) **16-18 year old** 12 months (n=43) 24 months (n=35) **18-20 year old** 12 months (n=23) 24 months (n=26)	2 year RCT	Increment in decayed, missing, filled and sound tooth surfaces (DMFS)	Mean total time (minutes) for examination and treatment	Resource Use
Wang and Holst, 1995, Norway	12.5 (mean) months vs. 13.7 (mean) months	children aged 3-18 years of age (approx.2750)	2 year cohort	Decline in number of new decayed teeth	Mean Clinical time (min) (examination+ treatment) spent per patient-excluding orthodontic treatment	Resource Use
Lunder, 1994, Norway	12 vs. 18 months	46 high school children	7 year Current study (ecological)	Increment in DMFS	Overall mean time/patient Examination mean time/patient	Resource use

TABLE 5: Oral Health Review Economics Papers

Study	Comparison	Effectiveness	Cost or resource used	Incremental cost-effectiveness
Davenport et al., 2003, UK	3 vs. 6 6 vs. 12 12 vs. 18 18 vs. 24 24 vs. 36	**Decay-free teeth (DMFT/dmft)** age 80 / age 6 0.2 / 0.1 0.1 / 0.2 0.6 / 0.2 1.3 / 0.2 3.1 / 0.4	**Incremental cost (£)** age 80 / age 6 200 / 64 75 / 31 15 / 9 21 / 4 2 / 3	**Incremental cost per extra decay free tooth at (£) (manual, non-flouridated)** age 80 / age 6 907 / 533 538 / 154 27 / 52 17 / 23 1 / 8
Dawson and Smales, 1992, Australia	6 vs. 12 months	**Decrease in number of restorations** 0.1* **Decrease in restoration 75% survival** 1.23*	Incremental cost of treatment and examination -$AUS36	– Average cost of treatment was significantly related to the frequency of examination. – Restoration longevity/the number of restorations received were not significantly influenced by recall frequency. – More frequent attenders received more expensive treatments rather than more treatment.
Wang et al., 1992, Norway	12 vs. 24 months **Age Group** 3–5 years 16–18 years 18–20 year	**DMFS Increment*** 0.9 1.2 0.5	**Difference in Examination time (min)** -16 -21 -27 **Difference in Treatment time* (min)** -5 -1 -2 **Difference in Total time (min)** -10 -18 -30	– The longer interval was associated with greater DMFS but this was not statistically significant. – There was no significant relationship between the length of interval and the treatment time. – Examination time and total time were significantly shorter for patients examined every 24 months than for patients examined every 12 months. – 30% reduction in clinical time was obtained due to less time being spent on examinations.
Wang and Holst, 1995, Norway	12.5 vs. 13.7 months	**Decline in number of decayed teeth** 0.06	**Difference in Clinical time (min) (examination+treatment)** -8	– Dental health in children did not change after extending recall intervals. – 10% increase in interval length corresponds to a 14% reduction in dentists equivalent time.
Lunder, 1994, Norway	12 vs. 18 months	**DMFS increment** 0.8	**Overall mean time/ patient** -45 minutes **Examination mean time/ patient** -31 minutes	–

*Not statistically significant

3. The Context of Dental Recall

As noted in the previous Chapter, based on a systematic review of the evidence on the effectiveness of routine dental checks of different recall frequencies, there is a lack of good quality, directly applicable research with which to inform clinical practice on assigning appropriate recall intervals. This absence of evidence complicated the task of fulfilling the original remit given by the Department of Health and the Welsh Assembly Government, namely: *"To prepare guidance for the NHS in England and Wales, on the clinical and cost-effectiveness of a dental recall examination for all patients at an interval **based on the risk from oral disease"** (our emphasis). The GDG decided that, in order to fulfil this remit, further literature (other than that directly relevant to addressing the Key Clinical Questions detailed in the previous Chapter) would have to be explored. Specifically, the GDG felt that the concept of risk as applied to provision of dental care and the possibility of developing a 'risk-based recall interval' should be explored.

Risk is the probability of an event occurring in a specific time (Reich et al. 1999). Applied to a health event, risk is the probability of an individual developing a given disease or experiencing a health status change over a specified period. Extending the definition of risk to the term 'risk factor' implies that there are certain factors associated with an increased probability of an individual developing a disease or experiencing a health status (Beck 1990). The premise underpinning the application of these concepts to the selection of an appropriate recall interval for an individual patient is that the frequency and type of oral health supervision needed by an individual patient can be based on a patient's risk of developing future disease or of existing disease progressing. Thus, the operating premise

of a risk based recall interval between Oral Health Reviews (OHRs) is that patients deemed to be at increased risk may benefit from more frequent OHRs and patients deemed to be at low risk may need to be recalled less frequently. The rationale for reducing the interval between Oral Health Reviews for patients deemed to be at increased risk is that the OHR affords an opportunity for primary prevention (the prevention of oral disease before it occurs) and secondary prevention (limiting the progression and effect of oral diseases at as early a stage as possible after onset). Based on these premises and assumptions the GDG decided to examine the literature surrounding clinical, behavioural and etiological factors that could be used by clinicians to determine a patient's risk of acquiring new disease or the risk of existing disease progressing. The GDG further considered that aspects of the natural history of oral diseases should also be examined, in particular the rate of progression of oral diseases. The GDG also wished to ensure that the guideline would be grounded in the principles of modern preventive management of oral diseases and would reflect the evolution of NHS dentistry from a restorative-centred approach towards a more preventive-oriented and clinically effective way of meeting patient needs. In addition, it was also considered important to examine the literature surrounding patients' satisfaction with the current NHS dental services and factors influencing dental attendance.

In order to explore these issues, the GDG formulated appropriate contextual questions relating to risk factors for dental caries, periodontal disease and oral cancer, the rate of progression of oral diseases and the early detection and preventive management of oral diseases. In developing and prioritising the

contextual questions to be addressed, two issues were considered:

a) the relevance and usefulness of these questions in developing the guideline

b) the work reasonably achievable in the limited time available

Many of the contextual questions posed by the GDG, in and of themselves, could have provided the focus for a separate systematic review. However, it was agreed by the GDG that, for the purposes of developing this guideline, a systematic review of the evidence in relation to each of these questions was neither appropriate nor feasible. In relation to each question, it was agreed that a search would be made for existing systematic reviews or other high quality and reliable evidence. Members of the GDG with expertise in that particular topic area were also consulted for references to pertinent literature for each question.

The literature reviewed in order to address the contextual questions posed by the GDG is presented in the subsequent sections in this Chapter. The GDG also considered the issues of longevity of dental restorations, the accuracy of basic diagnostic methods used by clinicians for detecting carious lesions in primary and permanent teeth, and the epidemiology of dental caries of children (Appendix F).

3.1 Dental Caries

For some of the background dental caries questions, the review team were able to draw upon a series of systematic reviews presented at the National Institute of Health Consensus Development Conference on the diagnosis and management of dental caries throughout life (March 26 – 28, 2001). Some of the questions addressed at this Conference using systematic review methods were particularly relevant to this guideline (for example, *"what are the best indicators for an increased risk of dental caries?"*).

3.1.1 Caries Risk Assessment

SUMMARY OF THE LITERATURE REVIEWED

> The most consistent predictor of caries risk is past caries experience (clinical evidence of previous disease)

> Caries risk assessment for individual patients can be carried out by the clinician using information readily obtained at an oral health review

> The clinical judgement of the dentist and his or her ability to combine risk factors, based on their knowledge of the patient and clinical and socio-demographic information is as good as, or better than, any other method of predicting caries risk

> The following should be considered when assessing caries risk for an individual patient: Medical History; Social History; Dietary Habits; Use of Fluoride; Clinical Evidence; Oral Hygiene; Salivary flow rate

> Assessment of caries risk should be repeated every time a patient attends for an oral health review

Over the past four decades, changes have been observed in the prevalence of dental caries and in the distribution and pattern of the disease in the UK. Although overall caries levels have declined significantly, this improvement has not been uniformly experienced throughout the population. Epidemiological studies have demonstrated that the distribution of dental caries is skewed, with most of the disease being concentrated in a minority of the population. There is also considerable geographic variation in caries experience across England and Wales on a regional and county basis. Generally lower levels of mean caries prevalence (DMFT <1 (12 year olds) have been reported in the south, the west and the midlands compared with the rest of England, Wales and the Isle of Man (mean DMFT levels between 1.01 and 1.50).

Contemporary changes in the pattern and distribution of dental caries have led to increasing research interest in caries risk assessment and in identifying 'high risk' susceptible individuals who can be targeted for preventive intervention. The aim of caries risk assessment is to predict future disease and disease progression. However, the precise estimation of future caries risk is difficult as dental caries is an etiologically complex and multi-factorial disease process and there are many factors that can impinge on an individual patient's caries risk. Nevertheless, caries risk assessment can be regarded as an important part of planning for prevention and provides a basis for the provision of dental care as well as planning recall appointments (Adelaide University et al. 1999).

In reviewing the caries risk assessment literature, the Guideline Development Group decided to examine 1) the predictive validities of currently available multivariate caries risk assessment strategies and 2) to ascertain the best indicators for an increased risk of dental caries.

We found one recent systematic review (Zero et al. 2001) evaluating the degree to which various combinations of risk indicators could predict dental caries (*that is*, the predictive validity of the test) in primary and permanent teeth. The authors of this review emphasised the paucity of randomised longitudinal studies available to inform clinical practice. Of all the models reviewed, none of those graded as being of good quality reached the desirable combined level of sensitivity and specificity (160%). On the basis of the available evidence it was concluded that, in general, the best indicators of caries risk could easily be obtained from dental charts and did not require additional testing (*for example*, microbiological examinations). Previous caries experience was also found to be an important predictor in most models tested for primary, permanent and root surface caries. Two of the longitudinal studies reviewed (graded as being of 'good quality') found that predicted caries by the clinician, using routinely available clinical and socio-demographic information, was an important predictor and as good as, or better than, other methods for predicting caries risk (Evidence Grade 2++).

In identifying the best indicators of increased caries risk we drew upon the findings of a number of systematic reviews that were used in developing a National Institutes of Health Consensus Statement on the Diagnosis and Management of Dental Caries Throughout Life (National Institutes of Health 2001). The conclusions of these reviews can be summarised as follows:

> There is evidence of matrilinear transmission of mutans streptococci in early childhood. Hence, the presence of caries in mothers and siblings is an indicator of increased caries risk for an individual child.

> Low socio-economic status is associated with elevated caries levels. Low socio-economic status may be associated with reduced access to care, reduced oral health aspirations and health behaviours that may enhance caries risk.

> Regular brushing with a fluoride containing toothpaste reduces caries risk.

> Conditions that may compromise the long-term maintenance of good oral hygiene are positively associated with caries risk. These include the presence of multiple restorations and oral appliances and physical and mental disabilities which may result in a decreased ability to perform effective oral hygiene.

> Fermentable carbohydrate consumption is associated with caries, particularly in the absence of fluoride. The frequency, amount and consistency of sugar containing foods and drinks consumed may impact on a patient's caries risk. Long-term regular doses of medications containing glucose, fructose or sucrose may also increase caries risk. The relationship between sugar consumption and caries is much weaker in the modern age of fluoride exposure than it used to be.

> Certain medical conditions (for example, Sjögrens syndrome), pharmacological agents with xerostomic side-effects (for example, anti-cholinergics, tricyclic antidepressants) and head and neck radiation therapy, can lower salivary flow rates to levels that will dramatically elevate a patient's risk of caries

All of the above factors, together with clinical evidence of previous disease, should be considered in assessing a patient's caries risk. As an individual's caries risk status may change over time, risk assessment must be an ongoing process and should be carried out every time a patient attends for an oral health review.

A patient's caries risk should be reviewed in the light of each new clinical examination and any relevant change in their dental, medical and social history and any alteration in their diet and oral hygiene practices.

3.1.2   Rate of Progression of Dental Caries

SUMMARY OF THE LITERATURE REVIEWED

> Literature examining the rate of progression of dental caries has to be interpreted cautiously due to the limited quantity and variable quality of the available evidence and considerable study heterogeneity

> On an individual patient basis, progression rates are very variable

> There is evidence that the rate of progression of caries can be more rapid in children and adolescents than in many older persons

> There is a paucity of evidence on: lesion progression in older adults, the rate of progression of occlusal caries, dentine lesions, free smooth surface lesions and root surface lesions

Most of the available information on caries progression emanates from radiographic studies of approximal lesion progression in the permanent teeth of children and young adults. There is sparse information on lesion progression in older adults and on the rate of progression of occlusal caries, dentine lesions, free smooth surface lesions and root surface lesions. There is also a paucity of data available on caries progression in primary teeth and many of these studies are confounded by the presence of preventive regimes (Tinanoff et al. 2001). Reviews of the caries progression literature illustrate the different populations, settings, treatment variables and measurement variables used in different studies

(Mejàre et al. 2003; Kay et al. 1995; Pitts 1983). Comparisons of data from these studies are rendered problematic by variations in diagnostic criteria, examiner inconsistencies and external factors influencing the natural history of lesion dynamics (for example, varying exposures of the populations under investigation to fluoride). The limited quantity and variable quality of the available evidence, and the considerable study heterogeneity, renders it difficult to draw anything other than the following very broad and general conclusions from this body of literature:

> On an individual patient basis, progression rates are very variable and differ between individuals as well as between lesions within an individual

> For the majority of individuals, the progression of approximal carious lesions in permanent teeth is a slow process and large numbers of lesions can remain apparently unchanged for long periods (Pitts 1983)

> The time for which caries remains confined to the enamel radiographically varies considerably. A mean time of 3 to 4 years has been reported (Pitts 1983)

> Caution should be exercised in the interpretation of 'mean time' figures as the rate of progression is more rapid in 'high risk' or 'caries active' individuals (Shwartz et al. 1984)

> The rate of progression through the enamel in permanent teeth appears to be relatively faster in young children (< 12 years) when compared with adolescents and adults (Mejare et al. 2000; Shwartz et al. 1984)

> The rate of progression through enamel is slower in populations and individuals with adequate fluoride exposure (Lawrence et al. 1997)

> The limited data available on lesion progression in primary teeth suggest that the rate of progression is faster than in permanent teeth

> The limited data available on the rate of progression in dentine, suggest that progression rates are faster than in enamel (Mejare et al. 1999; Pine et al. 1996)

> From the limited data available, lesion progression in adults does not appear to be related to age and there are no major differences in the rate of progression between younger and older adults (Berkey et al. 1988; Foster 1998)

> The exact range of rates of progression of free smooth surface lesions is not known

> The natural history of root caries is largely unknown as is the rate of progression through root surface cementum (Banting 2001; Leake 2001).

3.1.3   Threshold for intervention

SUMMARY OF THE LITERATURE REVIEWED

> Early caries lesions can be arrested or even reversed thus justifying consideration of the use of remineralising procedures (preventive intervention) for such lesions as opposed to automatic restorative intervention.

> Contemporary emphasis is placed on cavitation (a break in the continuity of the enamel surface) as a threshold for restorative intervention rather than dentine involvement (depth of the lesion)

> Operative intervention of cavitated lesions is generally indicated to restore the integrity of the tooth surface and allow for plaque removal by the patient

> Progressive hidden dentinal lesions can sometimes be found in sites that appear clinically sound ('hidden' or 'occult' caries). These lesions should be scheduled for operative care

> Radiographic findings must be considered with all other available clinical information on a patient when planning care.

Over the past four decades the approach to the provision of dental care in many developed countries is considered to have undergone a progressive shift from a 'restorative phase,' where the detection of caries lesions was promptly followed by lesion excision and restoration placement, to a less interventive 'preventive phase,' where the emphasis is on primary and secondary prevention and where

restorations are provided when a certain threshold of lesion severity has been exceeded (Murray et al. 1997). This change in practice has been influenced by number of factors including an improved understanding of the caries process, contemporary changes in the epidemiology of dental caries and an alteration in the rate of progression of the disease. In particular, a slowing in the rate of progression of early caries lesions through the enamel and the fact that early lesions can be arrested or even reversed justifies consideration of the use of remineralising procedures (preventive intervention) for such lesions as opposed to automatic restorative intervention.

In terms of the clinical management of caries and for successful treatment decisions to be made, it is important to know at what stage a carious lesion is likely to progress, irrespective of efforts to arrest it by common preventive means and, hence, when restorative intervention is warranted. There is a continuing debate in Europe on precisely where this restorative threshold should lie. Increasing emphasis has been placed on cavitation (a break in the continuity of the enamel surface) as a threshold for restorative intervention, rather than dentine involvement (depth of the lesion), per se (Pitts 2001). The threshold for intervention may also vary depending on the tooth surface affected by caries.

3.1.4   Occlusal surface caries

In general the limit for arresting occlusal caries is considered to be clinical cavitation. A number of studies have found that when an occlusal lesion is cavitated the dentine is always involved in the process, the lesion contains many micro-organisms and can generally be considered as an 'active' lesion (Ekstrand et al. 1995; Ekstrand et al. 1997; Ekstrand et al. 1998b; Espelid et al. 1994; van Amerongen et al. 1992). The opinion that cavitated lesions inevitably progress provides the basis for considering operative treatment of such lesions a necessity (Lunder et al. 1996). This inevitable progression is attributed to the impossibility of a thorough plaque removal once cavitation has occurred and operative intervention is generally indicated in order to restore the integrity of the tooth surface and allow for appropriate cleaning. However, it is also important to appreciate that operative intervention for occlusal surface lesions may be required before cavitation

has taken place. The decision when to intervene and restore an occlusal surface lesion is complicated by an apparent change in the presentation of caries in recent decades, particularly with the widespread availability of fluoride, in which cavitation appears to occur at a later stage. It is now recognised that progressive, hidden dentinal lesions can sometimes be found in sites that appear clinically sound ('hidden' or 'occult' caries). Cavitated occlusal lesions into dentine should be scheduled for operative care. Occlusal surfaces with a suspicion of hidden dentine caries should be investigated carefully.

3.1.5 Caries on contacting approximal surfaces

The restorative threshold for contacting approximal surfaces is probably reached when frank clinical cavitation occurs. As these surfaces are generally inaccessible to visual examination, the clinician usually has to rely on the use of radiographs as an aid to diagnosis. However, although radiographs can provide an estimate of the depth of lesion penetration towards the pulp, they are unable to provide direct and unambiguous evidence about cavitation at approximal sites. Traditionally, dental practice has adopted the criterion that restorations should be placed when an approximal radiolucency has reached the junction of the enamel and the dentine (Tyas et al. 2001). However, a problem with adopting this criterion is that it cannot be assumed that all radiolucencies that have reached this point represent cavitation.

Several clinical studies have related radiographic appearance with cavitation in permanent teeth. Where a radiolucency has reached the inner half of dentine, the probability of cavitation is high (Mejàre et al. 2003) and restorative intervention is warranted. However, when radiolucency is confined to the outer half of dentine, cavitation may or may not be present and clinical judgement should be used to determine when restorative intervention, rather than preventive maintenance and monitoring, is warranted. This clinical decision is facilitated by research which suggests that cavitation is more likely in 'high risk' patients and where the adjacent gingival papilla is inflamed (Ekstrand et al. 1998a; Lunder et al. 1996; Ratledge et al. 2001). Radiographic findings must thus be considered

jointly with all other available clinical information on a patient when planning care.

3.1.6 Restorative threshold of free smooth surface lesions

The accessibility of free smooth surface lesions means that they may be amenable to preventive regimes, even when cavitated. In this context, adequate plaque removal, exposure to fluoride and appropriate dietary modification may provide an environment conducive to the arrest of cavitated carious lesions on free smooth surfaces. Similar arguments apply to active lesions on root surfaces which can be rendered inactive by daily plaque removal and adequate exposure to fluoride (Nyvad et al. 1986; Nyvad et al. 1997). The ability to remove plaque is critical in order to arrest active carious lesions. If a patient is unable to access such lesions and remove plaque adequately, operative intervention is necessary.

For all of the above lesions, the threshold for intervention will also be influenced by the values and preferences of the patient for treatment and outcomes, which may be different from those of the clinician.

3.2 Periodontal Diseases

3.2.1 Summary of the Literature Reviewed

> The main risk factors for the development of periodontal disease include the presence of plaque, smoking and diabetes

> There is a paucity of data investigating the impact of gingivitis on oral health and well being

> Untreated periodontal disease is likely to progress faster than treated periodontal disease

Epidemiological studies of periodontal diseases are complicated by the diversity of measures used to describe and quantify them and the lack of consensus as to a uniform definition and classification (Kingman et al. 2002). This is reflected in the estimates given by the World Health Organisation Global Data Bank (World Health Organisation 2004) which state the prevalence of moderate severity disease occurs in 2 to 67% of

individuals and that advanced disease occurs in 1 to 79% of the population.

Tooth loss might be the true clinical outcome for periodontal disease but can occur for other reasons, even in those with established destructive periodontitis (Nunn 2003). Consequently, alternatives such as probing depth and attachment level are often used as surrogate outcomes, particularly to determine treatment need or response. Hujoel provides some evidence for the validity of these measures (Hujoel et al. 1999). The effect of these uncertainties may over- or underestimate treatment need. For the patient, the impact of disease on their quality of life and well-being is also important but few studies have yet investigated the effect of periodontal status on these measures.

3.2.2 Gingivitis

Gingivitis is an inflammation of the superficial gum tissues. It is caused by the accumulation of bacterial plaque at the gum line (Loe et al. 1965; Thielade 1986). Gingivitis can be recognised by the signs of bleeding from the gums (for instance following tooth brushing), a change from pink to red colouration and mild tenderness from the edges of the gum. These signs are often missed or thought to be normal changes. Thorough and regular removal of plaque by methods such as tooth brushing and flossing will allow health to be re-established without irreversible effects to the gums.

Gingivitis is highly prevalent in most populations and at most ages (Albandar 2002b; Corbet et al. 2002; Sheiham et al. 1986) with global values ranging from 50-90% of populations. The fact that gingivitis can be a precursor to more severe periodontal disease (periodontitis) has traditionally been regarded as its greatest significance. However, there has been surprisingly little research looking at the effect of this condition on future oral health and wellbeing. Since the condition affects the majority of people such information is critical to the development of policy on managing gingivitis.

We decided to examine the impact of gingivitis on the well being and oral health of an individual. Three areas of interest were considered: the impact of gingivitis on quality of life, the impact of gingivits

on oral diseases, and the impact of gingivitis on restorations, for example restoration longevity or the integrity of the restoration margin. No studies were found that directly investigated gingivitis and the quality of life on an individual. However, some studies looked at the impact of periodontal health in general (Jones et al. 2001; Needleman et al. 2004; Peek et al. 2002). The data suggest that there is an effect although it is not possible to discriminate the impact of gingivitis alone from all periodontal diseases. While gingivitis has shown to be a risk factor for periodontitis (Schatzle et al. 2003) and may be a risk indicator for caries (Ekstrand et al. 1998a), there are no data for gingivitis as a risk factor for other aspects of oral health. No studies were found researching the impact of gingivitis on restorations.

3.2.3 Risk factors

The accumulation of dental plaque at the gingival margin is considered to be the primary aetiological factor for the development of periodontal diseases (Socransky et al. 2003). Risk factors are considered to be those exposures, genetic influences or behaviours which modify the effect of plaque on the gingival tissues.

Although poor oral hygiene and plaque accumulation have been shown to correlate positively with gingivitis and the prevalence and severity of periodontal disease on a population level, oral hygiene is a much weaker predictor of periodontal tissue loss at the individual level (Albandar 2002a). Such a paradox might be explained by the contribution of risk factors which will vary substantially between individuals.

One readily assessable marker of risk is gingival bleeding. Lang and co-workers have shown that continuous absence of bleeding is a reliable predictor for the maintenance of periodontal health (Lang et al. 1990) that is, health gingival tissues predict further periodontal health. It is not clear whether this relationship holds true for both smokers and non-smokers.

A review by Nunn concludes smoking is "probably the most significant modifiable risk factor for periodontal disease (Nunn 2003). In the United States The Third National Health and Nutrition

Examination Survey (NHANES III) estimates that more than half the cases of periodontitis affecting adults may be due to smoking with 41.9% (6.4 million) cases of periodontitis due to current smoking and 10.9% (1.7 million) cases of periodontitis due to former smoking (Tomar et al. 2000). Albandar reports on several cross-sectional studies that show a strong association between the various types and intensity of smoking on gingival tissue, periodontal tissue loss and the severity of periodontitis. Smokers are shown to have between a two and seven fold increase in risk for having periodontitis and/or periodontal tissue loss than non-smokers. Heavy cigarette smoking is associated with more severe periodontal disease than light smoking and the number of smoking years significantly associated with tooth loss and periodontal disease, irrespective of other social and behavioural factors (Albandar 2002a). There is no evidence to suggest a safe level of smoking on periodontal health.

Nunn reports strong evidence for a direct relationship between diabetes and periodontitis (Nunn 2003). Both type I (insulin dependent) and type II (non-insulin dependent) diabetics appear to be at a higher risk than non-diabetics. However, certain sub-groups appear to be at particularly high risk. These include diabetics with poor oral hygiene and/or poor diabetic control and diabetic complications (Kinane 2001). Evidence has begun to emerge suggesting a bidirectional relationship between both types of diabetes and periodontal disease (Taylor 2001).

Albandar reports that studies show aggressive periodontitis to occur in families and suggests that genetic factors are partly responsible for the increased susceptibility to this disease (Albandar 2002a). Several other factors have only limited evidence of or a variable association with periodontal diseases. These are osteoporosis, rheumatoid arthritis, hormonal changes in the body associated with puberty and pregnancy, smokeless tobacco, low vitamin C or calcium intake, high alcohol intake, socioeconomic status, psychosocial factors such as stress, age, gender, race, and tooth or local factors such as occlusal discrepencies or tooth position (Albandar 2002a; Nunn 2003)

3.2.4 **Rates of Progression**

The Guideline Development Group was interested in a comparison of the rates of progression of treated and untreated chronic periodontitis. However, few studies investigated the rates of progression of periodontal disease for both treated and untreated subjects in the same study. As a surrogate for this, we looked at the data for treated periodontitis where the subjects are randomised to receive adequate maintenance care compared to inadequate care (Axelsson et al. 1981). The treatment group represents a treated and best case sample and the control group represent individuals where periodontitis is allowed to re-establish (a proxy for untreated and if anything, a modest estimate as the subjects have received some care). The results indicate that the percent of sites with at least 2mm loss of attachment over six years was 1% for subjects receiving adequate maintenance care and between 52% to 65% depending on the type of tooth (incisors, canines and molars) for those with inadequate maintenance care.

Cobb reviewed several studies to determine mean annualised rates of progression of untreated periodontal diseases determined by clinical probing depth and clinical attachment loss, or radiographic measurement of alveolar bone loss (Cobb 1996). Adjusting for one study that appeared to have some individuals with much greater progression than most populations (0.8mm per year) the range is 0 to 0.3mm per year.

However, annualised rates are highly problematic and tend to underestimate true disease progression. They are generally calculated across all sites in the mouth (whether per patient or across all sites of the study group rather than grouped per patient). The result is the inclusion of large numbers of non-progressing and healthy sites. Since progressing sites are less common than non-progressing sites the effect could be to underestimate disease progression of the sites that are progressing, often called 'loser' sites. Loser sites could be more common on teeth lost during follow-up. If the effect of the loss of sites on extracted teeth is not assessed, diseased or progressing sites will be preferentially lost from the data set, introducing a bias. Studies that report on rates of progression of 'loser'sites only indicate that

much greater rates can occur (Cobb 1996; Haffajee et al. 1991; Lindhe et al. 1989).

Converting this information into the Basic Periodontal Examination (BPE) suggests a mean annualised rate of progression of between 0.0 and 0.3mm per year for patients with no history of periodontitis and a BPE code of 0 (no residual pockets and no gingivitis and no calculus or overhangs), 1 or 2 (gingivitis or calculus/overhangs but no pockets) and for patients with a history of periodontitis and a BPE code of 0. For patients with a history of periodontitis and a BPE code of greater than 0 the data suggests a maximum annualised rate for progression of 3mm per year.

3.3 Oral Cancer

3.3.1 Summary of the Literature Reviewed

> On average about four people a day die from oral cancer in the UK

> The poor survival rate from oral cancer (50%) is generally attributed to the late diagnosis of oral cancer at an advanced stage when nodal involvement and neck metastases have occurred

> The incidence of oral cancer increases with age in both males and females, typically peaking in the seventh to eight decades of life. An increasing incidence in younger age groups (35-64 years) has been recently reported

> It has been consistently reported that there is a prognostic advantage associated with early detection of oral cancer. Early diagnosis allows for treatment with less aggressive therapies that are associated with less morbidity

> The incidence of oral cancer in males is around twice that in females in virtually all age groups. An exception to this has been reported in those under the age of 40 years where the usual male dominance does not appear to hold (See Section 3.3.2)

> Tobacco use (both smoking and smokeless tobacco) and excessive consumption of alcohol are the principal risk factors for oral cancer

> Cases of oral cancer have been reported in young persons (below the age of 45 years) with little or no exposure to tobacco or alcohol

> The use of toluidine blue dye as a screening tool in primary care should be discouraged

> Oral cancer often apparently arises de novo from clinically normal mucosa. The percentage of oral cancers arising from precursor lesions is not accurately known

> Potentially malignant lesions include leukoplakia and erythroplakia of varying clinical presentations. The incidence and prevalence of oral leukoplakia and erythroplakia in the UK are not known.

> The reported rates of malignant transformation of oral leukoplakia in the international literature range from 0.3 to 17.5%

> Lesions of leukoplakia on the floor of the mouth, lateral tongue and lower lip are most likely to show dysplastic or malignant changes

> Erythroplakia has a high potential for malignant transformation

> Clinicians should maintain a high index of suspicion for mucosal lesions that appear unusual. This vigilance is especially important for isolated lesions occurring in locations at higher risk for the development of squamous cell carcinoma, such as the lateral and ventral surfaces of the tongue and the floor of the mouth.

3.3.2 Epidemiology

Quoted incidence rates for oral cancer in the UK vary from 3.4 to 4.5 per 100,000 per annum (National Screening Committee: unpublished data 2001). In 1998, there were 4,081 cases of oral cancer diagnosed in the UK and in the year 2000, there were 1,649 deaths from the disease. On average about four people a day die from oral cancer in the UK. Oral cancer is also associated with significant morbidity arising as a consequence of the disease process itself and the therapy provided to oral cancer patients. Oral cancer associated morbidities include: psychosocial disability in terms of appearance, self-esteem and withdrawal from familial and other social

interactions, functional disabilities (difficulty in maintaining oral hygiene, swallowing and maintenance of nutritional status, difficulties in speaking), therapy-specific morbidities (related to neck dissection and radiotherapy) including thyroid and parathyroid dysfunction, xerostomia (dry mouth), osteo-necrosis of facial bones and the side-effects of chemotherapy (Rosati 1994).

As with all neoplasms, it is believed that oral cancer results from cumulative damage to epithelial cells over a period of time (Quinn et al. 2004). Hence, the incidence of the disease increases with age in both males and females, typically peaking in the seventh to eighth decades of life. Oral cancer is extremely rare below the age of about 40 years with approximately 4 – 6 % of oral cancers occurring below this age (Llewellyn et al. 2001). The incidence of oral cancer in males is around twice that in females in virtually all age groups. An exception to this has been reported in those under the age of 40 years, where the usual male dominance of the condition does not appear to hold (Llewellyn et al. 2001).

The overall age-standardised incidence of oral cancer has risen gradually since the 1990s and an increasing incidence in younger age groups (35 – 64 years) has been reported. In the 35 – 64 year age group, the incidence of tongue, mouth and oropharyngeal cancer rose from 3.61 per 100,000 per annum (1962 – '66) to 5.52 (1982 – '86) in males and from 1.85 to 2.19 in females (Hindle et al. 1996). More recently, Quinn and co-workers have reported a 40% increase in the incidence rate of lip, mouth and pharyngeal cancer in males aged 55 – 64 years in England and Wales between 1971 and 1997 and a 25% increase in the incidence rates in females of the same age group (Quinn et al. 2004).

In England and Wales the incidence of oral cancer exhibits marked regional variation with above average rates in the North of England and in Wales (Greenwood et al. 2003). The regional pattern in mortality is similar to that for incidence. It has been suggested that this difference may be related, at least in part, to material deprivation (O'Hanlon et al. 1997).

There is limited evidence available relating to ethnic variations in the incidence of oral cancer in England and Wales. Incidence rates appear to be higher in Asian immigrants (*that is,* immigrants from India, Pakistan, Bangladesh, Nepal and Sri Lanka). These ethnic differences have been attributed to tobacco use and tobacco chewing habits (specifically betel quid chewing) and to possible dietary factors, genetic predisposition, socio-economic differences and lack of awareness about the risk factors. Research into the incidence of oral cancer in specific ethnic groups in the UK is hampered by the fact that entry of ethnic group for an incident case only became part of the contract minimum data set in 1993 (Warnakulasuriya et al. 1999).

The overall five-year survival rate for oral cancer in England and Wales generally remains poor at an average of 50%. There has been little reported improvement in survival rates from oral cancer since the 1960s despite improvements in surgery and radiotherapy. This poor survival is generally attributed to the late diagnosis of most oral cancers at an advanced stage when nodal involvement and neck metastases have occurred (British Dental Association 2000; Epstein et al. 2002; Silverman 2001).

It has been consistently reported that there is a prognostic advantage associated with early detection of oral cancer. There is some evidence from studies of therapy for early stage oral cancer, that five-year survival is better for Stage I (where tumour diameter is 2cm or less and there is no nodal involvement and no metastases) than Stage II (where tumour diameter is >2cm but <4cm in diameter and there is no nodal involvement and no metastases). Hawkins and co-workers reviewed nine studies (published between 1980 and 1997) reporting data from retrospective reviews of patient charts (Hawkins et al. 1999). The only measure provided in all studies was the five-year survival rate: for Stage I five-year survival ranged from 57% to 90% and for Stage II, from 41% to 72%. However, all of these studies were case-series studies where a group of patients received an intervention and outcomes were assessed (there was no comparison group). The influence of lead-time bias was not considered in the statistical analysis of these data. This evidence is insufficient to establish with confidence whether earlier detection improves

the prognosis in patients with oral cancer. Nevertheless, early diagnosis is considered to be of importance in improving the outcome of therapy – diagnosis at earlier stages allows for treatment with less aggressive therapies that are associated with less morbidity (Epstein et al. 1997).

It should also be noted that small tumours may not necessarily be 'early' in the chronological sense – some small tumours may be very aggressive and at an advanced stage at presentation even though they are 2cm or less in their greatest dimension.

3.3.3   Risk factors for oral cancer

Tobacco use (both smoking and smokeless tobacco [*that is*, chewing tobacco, chewing tobacco with betel quid, snuff]) and excessive consumption of alcohol are recognised risk factors in the development of oral cancer (British Dental Association 2000; Conway et al. 2002; Horowitz et al. 2001; Rosati 1994). Both factors are associated with oral cancer in a dose response fashion and have a synergistic effect when combined (Moss S, Melia J, Rodrigues V, Tuomainen H: unpublished data 1997). There is some controversy over the precise role of alcohol as an independent risk factor for oral cancer. Nevertheless, the epidemiological evidence suggests that all forms of alcoholic drink are dangerous if heavily consumed. In this context there is evidence for the role of beer, wine and spirits as risk factors for oral cancer. In many studies only high levels of alcohol consumption (for example, >20oz/week or >55 drinks/week) have indicated significant increases in risk. Due to the tendency in self-reporting to underestimate alcohol intake, particularly high levels of intake, the effect of alcohol may be stronger than the studies suggest (Shah et al. 2003). Current UK recommendations are that men should not drink more than 21-28 units per week and women should not drink more than 14-21 units. One in four men and one in ten women in the UK are believed to be drinking over the recommended limits, with the number of habitual heavy drinkers estimated at 4 million (British Dental Association 2000).

In young persons (below the age of 45 years) who develop oral cancer, there is mixed evidence of the role of alcohol and tobacco as risk factors. Several studies have reported that the risk factors of smoking and alcohol consumption were present to varying degrees

in younger people with oral cancer. However, many authors also reported a complete lack of the usual aetiological factors associated with older patients *that is*, cases of oral cancer have been reported in young people who have had little or no exposure to tobacco or alcohol (Llewellyn et al. 2003).

A strong association between betel quid chewing and oral cancer and various potentially malignant lesions and conditions (primarily leukoplakia and oral submucous fibrosis) has been established. The addition of tobacco to the quid significantly increases the risk of oral cancer (Moss S, Melia J, Rodrigues V, Tuomainen H: unpublished data 1997; Thomas et al. 1993).

The habit of betel quid chewing is extremely common in India and South East Asia, Eastern Melanasia and the East African Coast. There is evidence that this habit remains prevalent in UK immigrants from these areas (Farrand et al. 2001). In the UK it has been reported that 19% of Bangladeshi men and 26% of women use some form of 'chewed tobacco' (Department of Health 2001). Other authors have reported that this may be as high as 39% and 82% respectively, in some areas (Bedi et al. 1995). Between 2% and 6% of UK Indian and Pakistani community members use some form of chewed tobacco.

Certain dietary deficiencies have been shown to play a role in oral carcinogenesis. Case control studies have consistently shown that oral cancer patients have histories of diets low in fruit and vegetables (*that is*, a diet low in Vitamin A and C has been associated with an increased risk of oral cancer) (Moss S, Melia J, Rodrigues V, Tuomainen H: unpublished data 1997). Iron deficiency anemia in combination with dysphagia and esophageal webs (Plummer-Vinson syndrome) is associated with an elevated risk for development of carcinoma.

It is well established that outdoor workers (for example, those involved in farming, fishing and postal delivery) are at greater risk from lip cancer because of long-term exposure to ultra-violet light. The risk of developing cancer of the lip increases with both the duration and frequency of exposure to ultraviolet radiation and is cumulative over time (Casiglia et al. 2001).

OTHER RISK FACTORS FOR ORAL CANCER

Other factors have been associated with an increased risk for oral cancer but evidence is not conclusive on whether the relationship is causal. These factors include:

> Previous carcinoma

> Bacterial and viral infections

> Genetics

> Occupational risk

> Poor oral hygiene

> Mouthwashes with a high alcohol content

> Immune Deficiency

3.3.4 The accuracy of clinical oral examinations in detecting oral cancer and potentially malignant conditions

The sensitivity and specificity of screening for oral cancer by clinical examination depend on such factors as the training of the individual performing the examination, and on the criteria used to determine which lesions are counted as 'positive' and warrant referral for further investigation. The yield and positive predictive value depend on the population screened (Rodrigues et al. 1998).

There have been a number of population-based studies of screening by clinical oral examination for oral cancer. These studies have generally found a relatively high specificity between 81 to 99%. However, the sensitivity has varied widely from 59 to 85%. The positive predictive values have varied from 31 to 87 % depending on the prevalence of oral cancer. Consequently, due to the low prevalence of oral cancer in developed countries, two significant issues for screening programmes are a low yield in the general population and a high proportion of false positive referrals (Hawkins et al. 1999).

In the UK, screening by clinical examination of the oral cavity has been reported to have a sensitivity ranging from 71 to 81% and a specificity of 99% or more when screening was carried out by general dental practitioners, with dental specialists' diagnosis as the gold standard (Rodrigues et al. 1998). A recent meta-analysis of measures of performance reported in

oral cancer and precancer screening studies concluded that systematic visual examination of the oral mucosa has a high discriminatory ability (Moles et al. 2002). In the latter study a weighted pooled average for sensitivity was calculated as 0.796. The corresponding value for specificity was 0.977

3.3.5 Toluidine blue dye

The use of toluidine blue dye has been suggested as an adjunct to visual examination in the identification and management of oral cancer since the 1960s and Toluidine blue dye oral cancer screening kits have been marketed to General Dental Practitioners in the UK. However, a recent systematic review of the evidence found wide variation in the sensitivity and specificity of the test (Gray et al. 2000). The authors of this review concluded that although toluidine blue might pick up additional cancers in high risk patients in secondary care, there was no evidence to support the use of toluidine blue as an adjunct to screening in primary care. The policy implications of this systematic review are that the use of toluidine blue dye as a screening tool in primary care should be discouraged.

3.3.6 Potentially malignant lesions and conditions

Although oral cancer often apparently arises de novo from clinically normal mucosa, there are also a number of clinically identifiable precursor lesions, which constitute a detectable pre-clinical phase (Downer 1997). The percentage of oral cancers which arise from precursor lesions is not accurately known, but has been estimated as more than 75% in India (a high incidence region for oral cancer). Although there are suggestions that the percentage of oral cancer cases arising *de novo* from clinically normal mucosa is greater in the Western world as compared to India, it has been argued that there are insufficient data to provide firm evidence particularly in countries such as the UK (Moss S, Melia J, Rodrigues V, Tuomainen H: unpublished data 1997).

Clinically identifiable precursor lesions are a heterogenous group of (usually) asymptomatic oral pathological entities with malignant potential. This broad group is generally classified under 'lesions' and 'conditions' – the latter are more generalised and widespread with significant systemic involvement. There is a paucity of data on the prevalence and

incidence of potentially malignant lesions and conditions in the UK. Potentially malignant lesions include *leukoplakia* and *erythroplakia* of varying clinical presentations (such as homogenous, verrucous, nodular or speckled) and mixed lesions.

LEUKOPLAKIA

Leukoplakia is usually defined as an adherent white patch that cannot be diagnosed as any other disease process. Leukoplakia is thus a clinical diagnosis of exclusion – if an oral white patch can be diagnosed as some other condition (*for example*, candidiasis, lichen planus) then the lesion should not be considered to be an example of leukoplakia. As there have been somewhat unsatisfactory definitions and changes in the definitions of leukoplakia over time, there has been a wide range of figures for prevalence and incidence reported in the international literature. Leukoplakia is the most common potentially malignant condition. The incidence and prevalence of oral leukoplakia in the UK are not known. However, outside the UK the prevalence has been estimated to range from 0.2 to 11.7%. The variation in prevalence between studies is likely to be due to varying methodology and clinical criteria used in the identification of leukoplakia as well as population differences in risk factor prevalence.

Data on malignant transformation of leukoplakia are limited and difficult to interpret because of variable follow up, disease definitions, diagnostic criteria and treatment interventions. Several clinical studies have been conducted in Europe and the US to assess the potential for malignant transformation of oral leukoplakia. The reported rates of malignant transformation in the international literature range from 0.3 to 17.5% (Rodrigues et al. 1998). Most of the earlier studies have reported a risk of malignant transformation in the range of 3.6 to 6 per cent. However, several more recent studies have reported malignant transformation rates ranging from 8.9 to 17.5 percent. Although the reason for these results is unclear, it may be due to a more restrictive definition of what is considered clinical leukoplakia and further underscores the seriousness of 'true leukoplakia' (Neville et al. 2002). Estimates of the percentage of leukoplakias that regress to normal vary between 4.6% per year in India to 28.6% in the USA.

The most common oral sites for leukoplakia are the buccal mucosa, alveolar mucosa, and lower lip. The location of leukoplakia has a significant correlation with the frequency of finding dysplastic or malignant changes at biopsy. Lesions on the floor of the mouth, lateral tongue, and lower lip are most likely to show dysplastic or malignant changes (Neville et al. 2002). Some leukoplakias occur in combination with adjacent red patches or erythroplakia. If the red and white areas are intermixed, the lesion is called a speckled leukoplakia or speckled erythroplakia. Speckled leukoplakia or mixed leukoplakia/erythroplakia are at greatest risk for showing dysplasia or carcinoma.

The risk of malignant transformation is also reported to vary with gender (higher among women), type of leukoplakia (higher among those that are idiopathic, non-homogenous, of a long duration), presence of Candida albicans, and presence of epithelial dysplasia. Leukoplakias in non-smokers are also more likely to undergo malignant transformation than leukoplakias in patients who do smoke. This should not be interpreted to detract from the well-established role of tobacco in oral carcinogenesis but may indicate that non-smokers who develop leukoplakia do so as a result of more potent carcinogenic factors (van der Waal et al. 1997).

ERYTHROPLAKIA

Erythroplakia is a term used analogously to leukoplakia to designate oral mucosal lesions that present as red areas and cannot be diagnosed as any other definable lesion (Shah et al. 2003). The prevalence of erythroplakia is not known but it is less common than leukoplakia. Studies in India and Burma have found a prevalence of 0.02 and 0.1% respectively (Shah et al. 2003). Oral erythroplakia occurs most frequently in older men (sixth and seventh decades) and appears as a red macule or plaque with a soft, velvety texture which may be slightly depressed below the level of the oral mucosa. The floor of the mouth, lateral tongue, retromolar pad and soft palate are most common sites of involvement. There are no studies reporting follow-up of series of cases of erythroplakia, perhaps due to its relatively low prevalence or due to its more active management. The rate of malignant transformation is

high: most studies of biopsied cases of erythroplakia have found that the majority show areas of epithelial dysplasia, carcinoma in situ or invasive cancer, leading most authors to conclude that erythroplakia has a high potential for malignant transformation. However, the role of erythroplakia as a precursor lesion, as opposed to an early sign of carcinoma in situ or invasive cancer, is not clear (Rodrigues et al. 1998).

ORAL LICHEN PLANUS

Lichen planus is a relatively common mucocutaneous disorder estimated to affect 0.5% to 2% of the general population. Lichen planus affects primarily middle-aged adults and the prevalence is greater among women. The classic skin lesions of the cutaneous form of lichen planus can be described as purplish, polygonal, planar, pruritic papules and plaques. These skin lesions commonly involve the flexor surfaces of the legs and arms, especially the wrists. Given that 30 – 50% of patients with oral lesions also have cutaneous lesions, the presence of these characteristic cutaneous lesions can aid in the diagnosis of oral lichen planus.

The malignant potential of oral lichen planus has been the subject of controversy for some time (Shah et al. 2003). Some studies indicate an increased risk of squamous cell carcinoma in patients with oral lichen planus lesions. This increased risk appears most common with the erosive and atrophic forms and in cases of lesions of the lateral border of the tongue. Other studies suggest that in some cases of purported malignant transformation, the malignancy may not have developed from true lesions of oral lichen planus but may instead have arisen from areas of dysplastic leukoplakia with a secondary lichenoid inflammatory infiltrate. The role of oral lichen planus as a true precursor lesion remains unclear (Rodrigues et al. 1998).

ORAL SUBMUCOUS FIBROSIS

Oral Submucous fibrosis (OSMF) is a chronic disease of the oral mucosa which manifests as a unique generalised fibrosis of the oral soft tissues. The condition is most frequently seen in South-East Asia, particularly in the Indian subcontinent and is strongly associated with the habit of betel quid chewing. Sporadic cases have been reported among non-Asians (Europeans) (Moss S, Melia J, Rodrigues V, Tuomainen H: unpublished data 1997).

3.4 Effectiveness of Dental Health Education and Oral Health Promotion

3.4.1 Summary of the Literature Reviewed

> Dental health education advice should be provided to individual patients at the chairside as this intervention has been shown to be beneficial (in the short term).

> The effectiveness of other means of delivering dental health education and oral health promotion is unclear since, despite its importance, some issues have been poorly researched and there are design challenges around the use of randomised controlled trials.

> Although evidence may be insufficient on whether it changes behaviour, dentists arguably have an ethical obligation to deliver good oral hygiene, dietary and smoking cessation advice to patients.

3.4.2 General Oral Health Promotion

We found two recent general systematic reviews on the effectiveness of health promotion and dental education on improving oral health. A report commissioned by Health Promotion Wales concluded that there is clear evidence that oral health education can change people's knowledge and improve their oral health (Sprod et al. 1996). However, it also concluded that while one-to-one oral health education is capable of reducing plaque levels, evidence strongly suggests that the changes achieved are short-term and unsustainable.

The authors of the second review were able to reach few definitive conclusions given the paucity of rigorous, well-designed studies in this area (Kay et al. 1998). From the studies that were rigorous and well-designed, Kay and Locker (Kay et al. 1998) were able to conclude that:

> Health promotion that leads to use of fluoride containing agents results in caries reduction

> Simple instruction in oral hygiene could alter people's behaviour in the short term

> School based health education aimed at improving oral hygiene has not been shown to be effective. One-to-one interventions are effective but are likely to be expensive due to professional costs (few studies looked at cost-benefit ratios or sustainability of programmes)

> There is no evidence that mass media programmes significantly alter any oral health related outcomes

It should be noted that only studies published in English were included in this study thus the results may be subject to publication bias. Although Kay and Locker reviewed each paper separately, they also aggregated the results. The papers included in the review differed on intervention, design, population and outcomes and thus it could be argued that it was inappropriate for Kay and Locker to pool the results as they did.

3.4.3 Smoking Cessation

Recent UK-based guidelines from the Health Education Authority conclude that health professionals can play a significant role in helping smokers to give up the habit (West et al. 2000). More specifically, a recent Cochrane review concluded that smoking cessation counselling delivered on an individual basis can assist smokers to quit (Lancaster et al. 2002). Although few studies have examined the role of dental professionals in this role, Watt and Daly suggest their success rates could be comparable with those in other primary care settings (Watt et al. 2003a). The key conclusions on efficacy from the recent UK guidelines (West et al. 2000) on offering smoking cessation advice to patients are:

> Brief advice (less than 5 minutes) can result in 1 to 3% of smokers quitting smoking each year

> The cessation rate increases to 6% if advice is up to 10 minutes and nicotine replacement therapy is utilized.

With regard to implementation, the recent UK guidelines recommend ascertaining a patient's smoking status at least once a year and the provision of GP advice to current smokers, during routine consultations, to stop smoking at least once a year.

Smokers may be more receptive to advice if it is linked with an existing medical condition. The smoker must be ready to quit and once an attempt to quit has been made, then follow-up should occur. There is no suggestion of when first follow-up should be made and how often additional follow-ups should occur. Additionally, these guidelines assume that people will be visiting their GP once a year, which may not be the case.

However, as noted earlier, these conclusions are based on studies looking at health professionals outside of dentistry. While Watt and Daly suggest the recommendations may be applied to health professionals in dentistry (Watt et al. 2003a), authors of a recent study (Rikard-Bell et al. 2003) suggest that more research is needed to determine whether smoking cessation advice delivered by dentists is indeed effective. They cite only one well-designed study that demonstrated significant results in smoking cessation following advice from a dentist, and three well-designed studies that failed to demonstrate successful results.

Rikard-Bell et al's own study in this area focused on patient views of dentist-delivered smoking cessation advice in Australia. They found that while 77% of patients agreed that dentists should provide smoking cessation advice, less than one-third of all smokers would try to quit upon advice from their dentist. Furthermore, over one-third of patients had little confidence in their dentist's knowledge of helping smokers quit.

3.4.4 Dietary Advice

Kay and Locker (Kay et al. 1998) reviewed a number of studies that looked at modifying the consumption of food and drink that contained sucrose. However, all studies used behavioural intentions or reported behaviour as outcome measures rather than those of oral health. Watt and McGlone (Watt et al. 2003b) found little evidence on dietary interventions delivered in primary dental care settings, and thus could not conclude whether giving dietary advice is effective.

3.5 Factors Affecting Dental Attendance and Satisfaction with the Current Service

3.5.1 Summary of the Literature Reviewed

> People will attend the dentist either for an Oral Health Review ('check-up') or for relief of symptoms. However, it is not clear from the literature reviewed here what the distribution of the population between these categories is, nor how stable it is.

> One study reported that regular attendees cited keeping their teeth as their main reason for their more frequent attendance. A larger body of literature on irregular attendees reported that people overwhelmingly cited a lack of perceived need to explain their symptomatic attendance pattern. Additional reasons commonly cited by patients for non-attendance were fear, cost and time. The attendance pattern of dependant groups (children and dependant adults) is determined by the motivations and priorities of their parents, guardians or carers.

> People are generally satisfied with their NHS dental service and consider interpersonal skills to be the most important quality of their dentist.

This chapter summarises the most recent and comprehensive literature on public views of NHS dentistry, specifically motivations for visiting the dentist, factors that affect attendance patterns and satisfaction with the current service. Our literature search found no evidence regarding the public's views on specific recall intervals or whether people follow their dentist's recommendations about when to return for a check-up. Due to substantial variation internationally in the provision of, and payment for, dental care, we limited the scope to studies conducted in England and Wales.

3.5.2 Motivation for visiting the dentist

As the patterns of dental attendance vary substantially in England and Wales, it was important to query a broad spectrum of the population on their motivation for visiting the dentist. Therefore, we included NHS registered patients, in addition to users of NHS dentistry who are not currently registered. This latter group may be regular attendees but having not attended for over 15 months, will have been deregistered. It is important to note that first, there may be a group of patients included in these studies who may not know their registration status and second, that all of the studies obtained findings from the self-reported attendance of patients and not their attendance from dental records.

Broadly speaking, there are two reasons a person will present to the dentist: either for an oral health review ('check-up') or for symptomatic relief. Their attendance *pattern*, however, can vary substantially and many studies have sought to classify different patterns. The most widely known terms in the UK for describing attendance are 'regular attendees', 'occasional attendees' and people who only attend when experiencing oral problems. These terms originated in the National Dental Health Survey 1968 but have different inclusion criteria from study-to-study (Newsome et al. 1999). Several authors however, have described the inadequacy of these terms. Newsome and coworkers for example, report that the terms 'regular' and 'occasional check-up' refers to both the frequency *and* reason for the visit, while the latter term refers only to the reason. As an alternative, the categories 'symptomatic attendee' and 'asymptomatic attendee' have recently been used to describe dental attendance. Asymptomatic attendees are defined as those people who have attended for a check-up at least twice in three years, although this definition can vary.

While information about self-reported attendance is collected through surveys such as the Office of Fair Trading (OFT), the ratio between symptomatic attendees and asymptomatic attendees will be more accurately reported using results from the dental records, as there will inevitably be some discrepancy between perceived self-reported attendance patterns versus real attendance. Within both of these sources however, there is an important issue with the stability of these categories; some people for example, will maintain a pattern of asymptomatic attendance before lapsing into larger periods of symptomatic attendance (Bullock et al. 2001).

3.5.3 Factors influencing the frequency with which NHS patients see their dentist

There was good evidence concerning factors influencing symptomatic attendance. However,

obtaining factors that prompted asymptomatic people to attend the dentist was more difficult. In terms of factors that affect the dental attendance of the general population, Bullock and coworkers reports results from a case control study set in a General Dental Practice in Stoke-on-Trent (Bullock et al. 2001). Two hundred patients, were divided into regular attendees (patients 18 yrs or over who had attended for two dental examinations in the last 2 years) and causal attendees (patients 18 or over who had not attended for a dental examination for the past 2 years and who attended at time of questionnaire in response to a dental problem) each completing a self-administered questionnaire. The most frequent reason cited by regular attendees for their asymptomatic attendance was 'to keep my teeth' (96%), followed by a concern with the early diagnosis of problems and the cosmetic appearance of teeth, the avoidance of pain and to encourage their children to attend the dentist regularly. Fifty six per cent of irregular attendees reported a fear or a dislike of dental treatment, followed by concerns about cost (41%) and time (32%). The OFT survey however, reported the primary reason for not being registered with a dentist was overwhelmingly lack of perceived need (43%), in a similar cohort of patients. Fear or dislike of dentists was much less frequently reported (2%). This discrepancy over the primary reason for non-attendance could possibly be explained by exploring the circumstances in which the research took place; questionnaires in the Bullock and coworkers study were completed in the dentists waiting room, which may have exacerbated any fears of the dentist/dental treatment (Bullock et al. 2001).

The results of several studies that focus on attendance of specific demographic groups report similar results in many instances. A sub-group analysis of older people within the Bullock and co-workers study, revealed that the prime reason for non-attendance was lack of perceived need (Bullock et al. 2001). A study on non-attending dentate older adults conducted within three areas of Britain by Steele and co-workers also reported a perception that there was no need to attend as the most common factor for non-attendance. A significant proportion of respondents also had concerns over the high financial cost (22-37.5%) and a fear or dislike of the treatment (23.6-38.2%) (Steele et al. 1996).

In another study of expectant mothers (Rogers et al. 1991), the main factor for non-attendance was the same although fear was reported more frequently than the other reports, which again, could have been exacerbated as the research was conducted in a clinical setting (Rogers et al. 1991).

Studies that focus on dependent groups (children, adults with disabilities and frail older people) demonstrate the way in which their dental attendance depends on other individuals. Hendricks and co-workers for example, reported that asymptomatic dental attendance among children is based on the tension in the relationship between the mother's positive attitude towards preventative care versus the fear and dislike of pain or discomfort caused to their children (Hendricks et al. 1990). Mothers' past experience of dentistry also influenced attendance patterns, in addition to a lack of confidence or issues of trust. Newsome and co-workers also outlined however, the way in which childhood dental anxiety can also negatively impact on attendance (Newsome et al. 1999). In a study on reported barriers to dental care for dependent older adults by Lester and co-workers, responses by both carers and patients themselves were recorded and compared (Lester et al. 1998). While patients most frequently reported lack of perceived need and cost as the most influential factors affecting their attendance, the carers of this same group of patients cited transport, health, cost and lack of escort as the most significant reasons.

3.5.4 Satisfaction with NHS dental services in England and Wales

The scope of this search was limited to people who believed they were currently registered with an NHS dentist (although there may be a sub-set of these who were unknowingly deregistered) and to their satisfaction with the NHS dental service. It did not cover access to NHS dental services; however, this is currently being reviewed by the National Audit Office. In addition, it was important that the views of a nationally representative sample of the population were sought as findings from regional studies may be misleading as service provision varies within England and Wales.

The most recent and comprehensive survey that considered the satisfaction of the public with NHS dentistry was conducted by the Office of Fair Trading (OFT) in 2003. The Consumer's Experience of Dental Services (Office of Fair Trading 2003) comprises nearly 4,000 interviews with adults over 18 years of age, nearly 2,000 of whom said they were registered with an NHS dentist. The OFT survey was carried out by a company called Capibus who ensure their samples are nationally and regionally representative, from urban and rural areas of Great Britain. Newsome and co-workers also provides a review of studies from 1980 to 1997 that look at patient satisfaction, although it is not apparent if these studies were restricted to the NHS service (Newsome et al. 1999). Two additional reports published recently, Calnan and co-workers (Calnan et al. 1999) and Hancock and co-workers (Hancock et al. 1999), were conducted on a much smaller scale and there is substantial overlap in conclusions.

The OFT study concluded that NHS patients are generally positive about quality of service they receive, information provided, advice and value for money (Office of Fair Trading 2003) although with the exception of value of money, private patients rated their dentists significantly higher. Calnan at al's work on NHS dental patients reported that there was some evidence to suggest that older people value the service slightly higher compared with the younger population, although the effect is small (Calnan et al. 2003). Related to this, there is also an overall confidence in dentists, which seems to increase with age. Both private and NHS patients aged 15-24 are significantly less confident than any age group, while those aged 65 and over have the highest mean score for confidence (in their dentists). In terms of areas of patients dissatisfaction, only 6% of both private and NHS patients in the OFT survey said that they had cause to complain. The most common grievance was bad treatment, followed by incompetence and pain and infection. Although only 3% of all patients actually did complain, it should be noted that 70% of NHS patients who had not complained, were not aware of the procedure to do so. There was also a low satisfaction among NHS patients regarding how the complaint was handled (Office of Fair Trading 2003).

While the general trends reported by the OFT study are reliable, the design of such surveys are limited by their lack of flexibility in possible responses, the potential for poor interpretation of the questions/ answers and their intention, which may create suspicion by respondents. The review by Newsome and co-workers for example, recognised that studies seeking to explore patient satisfaction with NHS dentistry often explore patient's perceptions of various service quality attributes (Newsome et al. 1999). For instance, although some patients may acknowledge instances in which they have received poor treatment, it is unlikely that they will be able to assess all levels of clinical competence in dentistry, yet the OFT survey cited 'bad treatment' as being the strongest determinant of dental satisfaction. This illustrates how impressions of the service are usually formed from a number of other features. The Newsome and co-workers review suggests that interpersonal factors (including provision of information, a caring attitude and discussion with the patient over treatment options) are consistently reported by patients to be the most important factors in a dentist. Furthermore, the cost of treatment per se, is not a source of contention with patients who are within the NHS system, but the *communication about fee* (*for example*, ignorance of charge until after the treatment or anger about the way in which the final bill was presented).

In conclusion, patients are generally satisfied with their NHS dental service and they view interpersonal factors with the dentist as the most important aspect of this satisfaction.

4. Economic Modelling

4.1 **Methods**

Currently, the most relevant published study of the cost-effectiveness of dental recall intervals is the model contained in the HTA Report. However, this study had a number of limitations, including the following:

> The HTA Report does not state what assumptions/data were used in the model that would lead to oral health being greater with shorter recall intervals

> It considered only dental caries prevention and not other aspects of oral health

> The outcome used for health gain in dental caries prevention (in the model for adults it was number of DMFT at age 80) was not ideal.

Using evidence from this Guideline's systematic review we decided to construct a modified model that would improve on limitations one and three. However, the incorporation of other aspects of oral health (limitation two) was not possible because of the lack of suitable data and also the absence of an overall measure of health outcome.

Despite these modifications, the model presented in this guideline (see Appendix E) is highly constrained by data availability and therefore cannot be used to decide optimal recall intervals. Its primary purpose is to explore the possible patterns of cost-effectiveness, identify the main parameters driving cost-effectiveness and highlight gaps in the evidence-base such that cost-effectiveness of recall intervals can be more adequately addressed in the future.

The new model took the following characteristics from the HTA Report model:

> **The objective was to estimate the relative cost-effectiveness of different recall intervals between 3 months and 36 months (based on caries risk)**

> **The target population was a cohort of general population of England and Wales aged 12 at baseline.[1]**

> **A cohort simulation (Markov model) estimated oral health and the number of both Oral Health Reviews (OHR) and caries treatment episodes over the lifetime of the patients to age 80.**

4.2 **Conclusions**

With the evidence base as it stands, we are currently a long way from determining the optimal dental recall intervals on the basis of cost-effectiveness. If we are to assess this in the future then research is needed that will:

Give a more precise definition of the components of and duration of an oral health review.

Further the development of outcome measures (such as the quality-adjusted tooth-year) that capture the most important aspects of oral health by weighting different health states according to people's preferences.

Estimate the rate of transmission over time between these different health states (e.g. between decayed and filled or between decayed and missing). Ideally this should be estimated separately for different risk subgroups

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[1] The HTA Report also conducted a model for children with deciduous dentition, however because of the lack of precision in the model parameters, we have restricted our analysis to the 12-80 age range.

Evaluate how different recall intervals affect the transmission rates, preferably in the context of a well-conducted clinical trial. (Ideally this should be stratified by risk subgroups)

For the chosen health outcome measure, determine a cost-effectiveness threshold, beyond which the clinical improvement would be considered too small to justify the cost.

The model presented in Appendix E represents a starting point from which more sophisticated models based on good quality data should be developed.

5. Recommendations

The recommendations in this guideline are designed to assist dentists in using their clinical judgement to assign recall intervals that are appropriate to the needs of individual patients. These recommendations are made by the Guideline Development Group (GDG) following a review of the scientific literature that was considered in the context of the Group's collective clinical expertise and views on patient preferences.

This guidance is evidence-based and the grading scheme (A, B, C, D, GPP) used for recommendations is that described in Chapter One. A recommendation's grade may not necessarily reflect the importance attached to the recommendation. For example, the Guideline Development Group agreed that the principles underlying the individualisation of recall intervals advocated in this guideline are particularly important. However, most of the related recommendations receive a D or good practice point (GPP) grading.

In order to provide assistance and support for clinicians in implementing these recommendations, an Appendix is provided (Appendix G) which consists of a *'checklist,'* a *diagram* and a series of *clinical scenarios.*

The *'checklist'* can be used when assessing a patient's risk of or from oral disease. Dentists may use this 'checklist' as it is or may modify it to develop their own electronic records or patient questionnaire. The manner in which this 'checklist' can be used as part of a risk assessment process is explained in Appendix G.

The *diagram* illustrates and summarises for clinicians the process of selecting, agreeing and reviewing appropriate recall intervals.

The *clinical* scenarios have been devised by the GDG to illustrate how recall interval selection will work in practice when the guidance is followed.

5.1 Part I: Clinical Recommendations

1. The recommended interval between oral health reviews should be determined specifically for each patient and tailored to meet his or her needs, on the basis of an assessment of disease levels and risk of or from dental disease. [D]

2. This assessment should integrate the evidence presented in this guideline with the clinical judgement and expertise of the dental team, and should be discussed with the patient. [GPP]

3. During an oral health review, the dental team (led by the dentist) should ensure that comprehensive histories are taken, examinations are conducted and initial preventive advice is given. This will allow the dental team and the patient (and/or his or her parent, guardian or carer) to discuss, where appropriate:

> **the effects of oral hygiene, diet, fluoride use, tobacco and alcohol on oral health [B]**

> **the risk factors (see the checklist in Appendix G) that may influence the patient's oral health, and their implications for deciding the appropriate recall interval [D]**

> **the outcome of previous care episodes and the suitability of previously recommended intervals [GPP]**

> the patient's ability or desire to visit the dentist at the recommended interval [GPP]

> the financial costs to the patient of having the oral health review and any subsequent treatments. [GPP]

4. The interval before the next oral health review should be chosen, either at the end of an oral health review if no further treatment is indicated, or on completion of a specific treatment journey. [GPP]

5. The recommended shortest and longest intervals between oral health reviews are as follows.

> **The shortest interval between oral health reviews for all patients should be 3 months. [GPP]**

   A recall interval of less than 3 months is not normally needed for a routine dental recall. A patient may need to be seen more frequently for specific reasons such as disease management, ongoing courses of treatment, emergency dental interventions, or episodes of specialist care, which are outside the scope of an oral health review.

> **The longest interval between oral health reviews for patients younger than 18 years should be 12 months. [GPP]**

   There is evidence that the rate of progression of dental caries can be more rapid in children and adolescents than in older people, and it seems to be faster in primary teeth than in permanent teeth (see Chapter Three, Section 3.1.2)). Periodic developmental assessment of the dentition is also required in children.

   Recall intervals of no longer than 12 months give the opportunity for delivering and reinforcing preventive advice and for raising awareness of the importance of good oral health. This is particularly important in young children, to lay the foundations for life-long dental health.

> **The longest interval between oral health reviews for patients aged 18 years and older should be 24 months. [GPP]**

   *Recall intervals for patients **who have repeatedly demonstrated that they can maintain oral health and who are not considered to be at risk of or from oral disease** may be extended over time up to an interval of 24 months. Intervals of longer than 24 months are undesirable because they could diminish the professional relationship between dentist and patient, and people's lifestyles may change.*

6. For practical reasons, the patient should be assigned a recall interval of 3, 6, 9 or 12 months if he or she is younger than 18 years, or 3, 6, 9, 12, 15, 18, 21 or 24 months if he or she is aged 18 years or older. [GPP]

7. The dentist should discuss the recommended recall interval with the patient and record this interval, and the patient's agreement or disagreement with it, in the current record-keeping system. [GPP]

8. The recall interval should be reviewed again at the next oral health review, to learn from the patient's responses to the oral care provided and the health outcomes achieved. This feedback and the findings of the oral health review should be used to adjust the next recall interval chosen. Patients should be informed that their recommended recall interval may vary over time. [GPP]

6. Implementation and Audit

6.1   **Background**

The bulk of the Primary Dental Care Services in the NHS in England have been provided (since 1948) by independent contractors working under so-called "item of service" arrangements in the General Dental Services (GDS). A smaller, salaried Community Dental Service (CDS) has provided dental primary care for children and special needs groups. Changes from the late 1990s introduced a number of locally tailored methods of delivering dental primary care under the Personal Dental Services (PDS) arrangements and, in turn, some of these have become linked to "dental access centres" in recent years.

In August 2002 the Department of Health Published a document called *"Options for Change"* (Department of Health 2002) which set out the results of an extended process of considering how NHS Dentistry could best be modernised to reflect the sentiments of the wider NHS Plan and at the same time address some of the concerns that had been raised for some years by both the profession and patient groups. This document mapped out a future shape for NHS Dental Primary Care. *Options for Change* listed eight key areas for significant change:

> **Local commissioning and funding.**

> **Methods of remuneration for GDPs.**

> **Prevention and Oral Health Assessments.**

> **The patient experience.**

> **Information and communication technology.**

> **Practice structure.**

> **Development of the Dental Team.**

> **Clinical Pathways.**

Since August 2002, new legislation has been introduced and a fundamental change in the methods of delivery and remuneration of primary care dentistry is being introduced. The Scope agreed for this Guideline specifically asked the Guideline Development Group to "take account of the current system of delivering dental care and also the policy direction in which the clinical and payment systems are being modernised" and referred to the Options document as the blueprint for this modernisation.

From April 2005 all contracts with General Dentists will be held with local primary care trusts (PCTs) and a new "Base Contract" will operate remunerating practices on the basis of a rolling average of previous earnings and expenditures. The direct link to item of service care will be broken. It is anticipated that this Base Contract will gradually evolve over coming years in a variety of ways with a focus on access and patient-centred preventive care services with an emphasis on quality rather than quantity of care.

Thus as the final form of this guidance will be published on 29th September 2004, the earliest the initial recalls according to this strategy could be planned would be at the end of 2004/early 2005. It would be expected that the majority would fall after April 1st 2005 and come under the new arrangements. It will be necessary to ensure that reasonable arrangements are put in place to make the position clear to both patients and the profession as new arrangements develop and evolve.

6.2   **Implementation**

This guidance contains a number of tools and suggestions to facilitate effective implementation and review. The provision in Appendix G of i) a comprehensive risk checklist with explanatory notes

ii) a diagram to illustrate the steps involved in recall interval selection and iii) a series of clinical scenarios which provide a range of worked clinical examples, all designed to help NHS dental practices and their patients get used to what will be for many a new way of planning and receiving routine NHS dental care.

NHS Clinical Care Pathways – A clinical care pathway is an outline of anticipated care, placed in an appropriate timeframe, to help a patient with a specific condition move progressively through a clinical experience to positive outcomes. NHS clinical care pathways are being developed to further the aims outlined in the Department of Health's strategy document *NHS Dentistry: Options for Change* (2002). The first clinical care pathway for NHS dentistry is being developed by the Dental Health Services Research Unit at the University of Dundee and deals with the initial oral health assessment and the subsequent oral health review (see diagram in Appendix A). It is being tested by NHS Options for Change field sites, which include dental practices, primary care trusts and strategic health authorities who volunteered to test the modernisation proposals outlined in *Options for Change*. The pathway accommodates the NICE recommendations on recall intervals and this should help a seamless move into modernised, preventive NHS dental care.

Support for Practices and Dental Teams – The NICE guideline, Quick Reference Guide, public information leaflets and posters and the patient version of the guidance should all ensure that easy-to-access information about the recall recommendations are widely available to dental practices and clinics delivering NHS care in England and Wales.

Support for Patients – This guideline is different from the majority of guidelines in that the whole population is affected. The guideline document, including an information leaflet and poster for the public, should ensure that easy access to information about the recall recommendations are widely available to all people in England and Wales.

Postgraduate and Continuing Education – It is hoped that the key messages of the guidance and the clinical, preventive philosophy behind it can be incorporated in planned educational activities.

NeLH, the virtual Centre for Improving Oral Health (vC-IOH) and the developing National Oral Health Knowledge Service – A number of developments in supporting and coordinating evidence-based dentistry are currently under development. Steps will be taken to ensure that the guidance appears on the National electronic Library for Health (NeLH) [www.nelh.nhs.uk] and that its rationale and recommendations are promoted by the virtual Centre for Improving Oral Health (vC-IOH) [www.dundee.ac.uk/dhsru/iks/mona/hotel1.htm] and are linked to new dental IT developments.

6.3 **Audit**

Patient records should reflect that appropriate recall intervals have been identified on the basis of the assessment of risk in discussion with the patient. The following four criteria can be used to audit adherence to the guideline recommendations:

> **At the end of each oral health review there is a record for each patient of an assessment of disease and disease risk.**

> **At the end of each oral health review, or at completion of treatment, there is a record for each patient of the recall interval recommended by the dentist for the next oral health review.**

> **The interval agreed each time, for each patient is:**
>   **– 3, 6, 9, or 12 months for patients younger than 18 years, or**
>   **– 3, 6, 9, 12, 15, 18, 21, or 24 months for patients aged 18 years or older.**

> **Where there is disagreement between dentist and patient over the recall interval, the reason for this is recorded.**

Given that the guideline recommendations will represent a significant departure from current practice for many dentists, the Guideline Development Group also recommends that:

> **The acceptability and performance of the guidance should be assessed routinely in order to refine and improve the guidance informing the recommended interval and the effectiveness of the Oral Health Assessment/Oral Health Review.**

This means that as the new arrangements for delivering dental care come in and settle down, an impact assessment of the introduction of this guidance should be introduced. It is hoped that arrangements can be made to establish what changes in recall behaviour are brought about by the publication of this guidance, although the simultaneous introduction of a number of changes may complicate this.

> **A new minimum dataset should be established, consistent with the new, more preventive, philosophy inherent in the evolving arrangements for NHS Dentistry. Data should be recorded routinely in such a way to facilitate its use for service improvement at the patient, practice, primary care trusts, Shadow Health Authority and national levels.**

Minimum Data requirements – it will be important for the profession, the PCTs and the Shadow Special Health Authority (Dental Practice Board) to agree a coherent and workable dataset to allow efficient collection of data and the comparison of what happens in different localities over time. Continuity of existing longitudinal data sets is necessary.

Audit at the Practice level – Recall intervals will make a ready and important audit topic at the practice level. Some coordinated production of audit tools may facilitate this process. The incorporation of the minimum data set into Dental IT software would help automate the data collection and reduce the administrative burden. It is important that any patient who may suffer from disease progression and is allocated a more extended recall should be monitored.

Audit at the local (PCT) level – this will become more important as PCTs develop the local arrangements and seek to understand the quality dimensions and patient acceptability of the new styles of dental care. The Strategic Health Authorities (SHAs) and Welsh Health Boards may also call for the (anonymised) results of such local audits.

Audit at National level – with the radical changes in commissioning NHS dental care, there will be a need to understand how the new arrangements are working and to evaluate the overall performance to the new systems and the quality of care being delivered. Once again, this will demand more of the new IT arrangements which hold the key to ready and efficient access to understanding change and quality.

New Dental and NHS-wide IT developments should, over time, allow much of this routine information to be collected without additional administrative burdens. It is essential that these needs are reflected in the design, specification and development of new IT systems and that these requirements are met while satisfying contemporary data protection and privacy requirements.

If not addressed early on, there is a danger that the automated collection and processing of audit data about dental recalls, which will be needed, may be compromised. This is due to the scale and pace of the remuneration changes which will be introduced in 2005. Confidentiality is a further consideration as appropriate information and agreement must be obtained from the patient, where necessary, to ensure that the legitimate use of patient information for improving the quality of patient care can continue.

6.4   **Research Recommendations**

While developing this guideline, the research evidence in a number of areas was found either to be inconclusive or not to exist. The absence of reliable research was partly a consequence of a lack of funding in certain areas and poor or inappropriate study design in others. Research in the following areas would help in updating this guideline and implementing it in general dental practice.

> Dental attendance patterns should be examined for changes after the publication of the guideline. To allow this, the future use of routine data for this purpose must be communicated appropriately to patients in order to satisfy confidentiality considerations.

> After publication of the guideline, information will be needed on whether patients visit the dentist at the agreed interval, and their reasons for this.

> Research is needed on the long-term clinical and cost effectiveness of one-to-one oral health advice and whether this may depend upon:
  – The frequency with which it is delivered
  – The physical/oral health of the patient
  – Other characteristics of the patient (for example, age, sex, social class, occupation)
  – The medium used to deliver the advice
  – Who delivers the advice

> Research is needed to examine the effects of varying dental recall intervals on oral health, and on which aspects of the oral health review influence oral health.

> Research is needed to examine the impact of oral health (relating to gingivitis, caries, periodontal disease and mucosal disease) on quality of life.

> Research is needed to examine the effects on periodontal health of routine scale and polish treatment (in conjunction with oral hygiene instruction) in different populations. Specifically, research is needed to examine the clinical effectiveness and cost effectiveness of providing this intervention at different time intervals

Research designs will need to accommodate the mix of arrangements (NHS, private and mixed configurations) under which dental primary care is provided.

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Glossary of Terms

Active carious lesion
Caries lesions may be classified according to their activity. The clinical distinction between active and arrested lesions is sometimes difficult to make. There will often be a continuum of transient changes from active to arrested and vice versa. A lesion considered to be progressive can be described as an active caries lesion. In contrast, a lesion that may have formed years previously and then stopped further progression can be referred to as an arrested or inactive caries lesion. Once cavitation has occurred, exposed dentine is a good indicator of activity status. Active or progressing caries in dentine is usually light brown in colour and very soft. In long standing caries, the dentine is usually much firmer to touch and dark in colour. Root caries also usually shows these characteristics (Adelaide University et al. 1998).

AIDS
Acquired Immune Deficiency Syndrome. AIDS is the result of damage to the immune system. A damaged immune system is unable to protect the body against certain specific 'opportunistic' infections and tumours.

Bulimia nervosa
A syndrome characterised by recurrent episodes of binge eating and by compensatory behaviour (vomiting, purging, fasting or exercising) in order to prevent weight gain. Binge eating is accompanied by a subjective feeling of loss of control over eating. This is a normal weight syndrome in which the body mass index (BMI) is maintained above $17.5 \text{ kg}/\text{m}^2$.

Caries experience
the sum of filled and unfilled cavities, together with any missing teeth resulting from decay.

Caries risk assessment
A process that attempts to identify people who are at greater risk for a high level of caries and who may need more oral health supervision and preventive intervention.

Cavitated lesions
Carious lesions where there is a visible macroscopic breakdown in the tooth surface (*that is*, a visible 'hole') and the area may have softened walls or floor.

Dental caries (dental decay, tooth decay or 'cavities')
An initially subsurface, 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.

Dental hygienist
The primary role of a dental hygienist is to educate patients to take care of their teeth and gums, including demonstrating cleaning techniques and providing advice about the effects of diet.

Dental therapist
A dental therapist carries out certain clinical work, and acts as an educator, teaching patients the necessary skills to enable them to maintain their oral hygiene effectively. A dental therapist works under direction and to the dentist's written prescription

Dentate
A term applied to a person who has one or more natural teeth present.

Dentist	A person qualified to practice dentistry. Dentists provide regular check ups on your teeth and gums. Part of their work involves teaching people to look after their teeth and gums in order to prevent problems. It also includes restoration of teeth damaged or lost by decay, trauma or other reasons, using a wide variety of techniques and materials.
Edentulous/edentate	A term applied to a person who has no natural teeth remaining.
Early childhood caries	Dental decay of the primary teeth ('baby' or 'first' teeth) of infants and young children (aged 1 to 5 years) often characterised by rapid destruction of tooth tissue.
Early, initial or incipient lesion	Refer to the stage of lesion development. Used to describe the first sign of a caries lesion on enamel that can be detected with the naked eye. An initial lesion appears as a white, opaque change (a white-spot) but not all white-spot lesions are incipient.
Fissure sealants (or 'sealants')	Plastic coatings applied to the surfaces of teeth with developmental pits and grooves (primarily the chewing surfaces of teeth) to protect the tooth surfaces from collecting food debris and bacteria that promote the development of dental decay.
Fluoride	A compound of the element fluorine. Fluoride is used in a variety of ways to reduce dental decay.
Gingivitis	A reversible inflammatory condition of the gum tissue, where the gum can appear reddened and swollen and frequently bleeds easily. It is usually caused by inadequate personal oral hygiene. Gingivitis is a precursor to periodontitis in some people.
'Hidden' or 'occult' caries	Non-cavitated lesions in dentine that may be overlooked on a visual clinical examination but which are large and demineralised enough to be detected radiographically.
HIV	Human Immunodeficiency Virus. A virus, belonging to a group of retroviruses, that can lead to AIDS.
HTA Report	Refers to the report "The clinical effectiveness and cost-effectiveness of routine dental checks: a systematic review and economic evaluation" written by Davenport et al. and published by the Health Technology Assessment NHS R& D HTA Programme(Davenport et al. 2003)
Inflammation	A localised protective response elicited by injury or destruction of tissue, which serves to destroy, dilute, or wall off both the injurious agent and the injured tissue. A cellular and vascular reaction of tissues to injury (American Academy of Periodontology 1996).
International Classification of Disease (ICD)	Most international databases for recording statistics on oral cancer use the International Classification of Diseases (ICD) coding system of the World Health Organisation (WHO). Most of the data currently available are expressed according to the ninth revision of this system (ICD-9).
Lesion arrest and lesion reversal	The progression of enamel lesions with macroscopically intact surfaces is often slow and such lesions do not inevitably progress to cavitation; they can stop (or be stopped via appropriate preventive intervention for example, application of topical fluoride) – lesion arrest, or even reverse (or be reversed by appropriate preventive intervention for example, application of topical fluoride) – lesion reversal/regression.
Meta-analysis	Results from a collection of independent studies (investigating the same treatment) are pooled, using statistical techniques to synthesise their findings into a single estimate of a treatment effect. Where studies are not compatible for example, because of differences in the study populations or in the outcomes measured, it may be inappropriate or even misleading to statistically pool results in this way.
Non-cavitated lesions	Lesions where there is no macroscopically visible disruption of the continuity of the enamel surface.

Non-cavitated smooth surface lesions in enamel	These lesions typically manifest on the smooth surfaces of teeth as chalky white or light brown demineralisation of the enamel where the discoloured area has no signs of cavitation after a careful visual inspection. Such lesions are usually located in areas where dental plaque may accumulate (close to the gingival margin). The surface of the area is matted (not glossy) when a tooth is dried.
Non-cavitated pit and fissure lesions in enamel	These lesions typically manifest as light or dark brown discoloration at the base of the pit or fissure with or without white demineralisation at the sides of the pit or fissure that can be detected visually after cleaning and drying the teeth.
Non-cavitated lesions in dentine	These lesions have visible signs of undermined enamel that show as opacity or discolouration beneath an apparently intact enamel surface.
Odds ratio	Odds are a way of representing probability, especially familiar for betting. In recent years odds ratios have become widely used in reports of clinical studies. They provide an estimate (usually with a *confidence interval*) for the effect of a treatment. Odds are used to convey the idea of 'risk' and an odds ratio of 1 between two treatment groups would imply that the risks of an adverse outcome were the same in each group.
Oral cancer	The term 'oral cancer' is used in this guideline to refer to cancer of the lip (ICD-9 code 140), tongue (code 141), gum (code 143), floor of mouth (code 144), other unspecified parts of the mouth (code 145), oropharynx (code 146), hypopharynx (code 148) and other ill-defined sites within the lip, oral cavity and pharynx (code 149). This definition excludes cancers of the salivary glands (code 142) and the nasopharynx (code 147).
Oral cavity	The mouth
Oral health	Oral health is a standard of health of the oral and related tissues which enables an individual to eat, speak, and socialise without active disease, discomfort or embarrassment and which contributes to general well-being (Oral Health Strategy Group 1994).
Oral Health Assessment	A comprehensive assessment of a patient's oral health status carried out when a patient first visits a practice. It involves taking full patient histories, carrying out thorough dental and head and neck examination and providing initial preventive advice. The findings are discussed between dentist and patient who then agree a provisional personalised care plan and a 'destination' for this particular journey of care (see Appendix A).
Oral Health Review	The continuing re-examination of a patient's oral health and risk status (see Appendix A).
Oral health risk assessment	A (prognostic) tool that helps dental professionals individualise oral health supervision. It is based on the concept that the frequency and type of oral health supervision needed by a person depends on the likelihood that specific diseases or conditions may develop. Risk assessment involves examining risk factors that may negatively impact an individuals oral health, and protective factors that promote oral health. Using risk assessment, the dental professional is better positioned to make specific preventive and treatment recommendations to reduce an individual patient's risk and improve their oral health (Bright Futures 1996).
Oral mucosa	The tissue lining the oral cavity.
Oral mucosal abnormalities	A disorder of the soft tissue that lines the mouth.
Periodontal disease	A cluster of diseases caused by microbial plaque and resulting in inflammatory responses and chronic destruction of the soft tissues and bone that support the teeth. Periodontal disease is a broad term encompassing several diseases of the gums and tissues supporting the teeth.

Periodontitis	Inflammation of the gums leading to the development of gum pockets with destruction of the soft tissue attachment of teeth and their supporting bone. Periodontitis is a major cause of tooth loss.
Pharynx	the muscular cavity behind the nose and throat
Plaque	Bacteria and their products which cling to the tooth surface when oral hygiene is neglected.
Preventive treatment approach	A dental care philosophy which encourages prevention and monitoring rather than early intervention (Davenport et al. 2003).
Primary caries	Caries lesions on unrestored tooth surfaces.
Primary prevention	Primary prevention protects people 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.
Probing attachment level	The distance from the cemento-enamel junction (CEJ) to the location of the tip of a periodontal probe inserted in the pocket with moderate probing force (Papapanou et al. 2003).
Probing depth	The distance from the gingival margin to the location of the tip of a periodontal probe inserted in the pocket with moderate probing force (Papapanou et al. 2003).
Rampant caries	Multiple active carious lesions occurring in the same patient. This frequently involves surfaces of teeth that do not usually experience dental caries (for example, the free smooth surfaces of anterior teeth). Patients with rampant caries can be classified according to the assumed causality for example, bottle or nursing caries, baby caries, early childhood caries, radiation caries or drug-induced caries.
Randomised controlled trial	A study to test a specific drug or other treatment in which people are randomly assigned to two (or more) groups: one (the experimental group) receiving the treatment that is being tested, and the other (the comparison or control group) receiving an alternative treatment, a placebo (dummy treatment) or no treatment. The two groups are followed up to compare differences in outcomes to see how effective the experimental treatment was. (Through randomisation, the groups should be similar in all aspects apart from the treatment they receive during the study.)
Recall interval	The time period, usually expressed in months or years, between an Oral Health Assessment and the first Oral Health Review, or between two Oral Health Reviews).
Recurrent or secondary caries	Caries lesions that develop adjacent to a filling or other dental restoration.
Restorative treatment approach	A dental care philosophy which encourages early intervention and repair of dental caries at an early stage (Davenport et al. 2003).
Risk	The probability of an event occurring in a specific time. In the context of preventive medicine and preventive dentistry risk, it is the probability of an individual developing a given disease or experiencing a particular health status over a specified period. Caries risk, for example, is the probability of an individual developing a carious lesion. By definition, risk is aimed at assessing developments in the future. However, it can only be assessed on the basis of symptoms present at, or having manifested themselves by, the time of assessment (Reich et al. 1999).
Risk factor	An exposure that is statistically related in some way to an outcome, *for example*, smoking is a risk factor for periodontitis. If present, a risk factor directly increases the probability of a disease occurring and if absent or removed, reduces the probability.

Root caries	Dental decay that occurs on the root portion of a tooth. Early lesions on root surfaces are often difficult to observe visually and require tactile examination with a blunt instrument for example, periodontal probe. Use of a periodontal probe will allow detection of the leathery consistency of demineralised cementum∕dentine. Colour change (darkening) is usually (but not always) present.
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.
Sensitivity	In diagnostic testing, it refers to the chance of having a positive test result given that you have the disease. 100% sensitivity means that all those with the disease will test positive, but this is not the same the other way around. A patient could have a positive test result but not have the disease – this is called a 'false positive'. The sensitivity of a test is also related to its 'negative predictive value' (true negatives) – a test with a sensitivity of 100% means that all those who get a negative test result do not have the disease. To fully judge the accuracy of a test, its specificity must also be considered.
Sjögren's syndrome	A condition which features abnormal dryness of the eyes, mouth and vagina. It is associated with diseases that arise from an immune system that is not working well. The basic cause is unknown. The dryness results from the reduced secretion of various kinds of glands, following invasion and damage by white cells (lymphocytes) that are part of the immune system.
Soft tissue lesion	An abnormality of the soft tissues of the oral cavity or pharynx.
Specificity	In diagnostic testing, it refers to the chance of having a negative test result given that you do not have the disease. 100% specificity means that all those without the disease will test negative, but this is not the same the other way around. A patient could have a negative test result yet still have the disease – this is called a 'false negative'. The specificity of a test is also related to its 'positive predictive value' (true positives) – a test with a specificity of 100% means that all those who get a positive test result definitely have the disease. To fully judge the accuracy of a test, its sensitivity must also be considered.
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.
Vocational Trainee	Vocational training in general dental practice is primarily aimed at the new dental graduate to provide the initial stage of general professional training and education. The Vocational Trainee (also known as Vocational Dental Practitioner) is encouraged to develop and expand the clinical and personal skills learned as an undergraduate during their vocational training year. New graduates have the opportunity during this year to consider their future – whether a career in general dental practice, the community dental service, or specialisation within dental practice or the hospital service.
White-spot lesion	Describes the first sign of a caries lesion on enamel that can be detected with the naked eye. However, whitespot lesions are not necessarily 'early' caries lesions – white-spot lesions may have been present for many years in an arrested state and it is thus misleading to describe such a lesion as 'early.'
Xerostomia	A condition in which the mouth is dry because of a lack of saliva