## 1. Project Title

**06/35/99: INTERVAL Dental Recalls Trial (Investigation of NICE Technologies for Enabling Risk-Variable-Adjusted-Length Dental Recalls Trial)**

## 2. Internal pilot and follow-on studies.

In accordance with the HTA Commissioning Board's (11 July 2007) request, the INTERVAL Dental Recalls Trial (06/35/99), which was assessed as being "excellent", incorporated a stand-alone feasibility phase, lasting 25 months. The feasibility phase included setting up the study, gaining authorisations (ethical, financial, and regulatory), employing study staff, creating the Case Report Forms, training of study personnel, creating the study databases (including randomisation and administration), and recruiting 10 practices to take part in the feasibility study. It was also concerned with running the study – randomising patients in the 10 centres concerned. As far as possible this feasibility phase was structured as an 'internal pilot' – that is, the intention was to mimic in every regard the architecture of the main trial and to include pilot data in the main study. At the end of this phase we produced a report on the feasibility of the study and assessed with HTA whether the criteria for progression to a full study were met. A final three-month period was the conditional phase, incorporating time allowed for a decision to be reached by HTA. Following the HTA's decision to scale up to the full trial, we will expand the centres from 10 to 44, reaching full capacity within the phase. As such, it was anticipated that incorporating the feasibility phase had the potential to only lengthen the entire study, if it went to full trial, by 9 months, depending upon the timing of the HTA decision. Crucially, it gave the research group the important opportunity to demonstrate feasibility. Additionally the feasibility phase provided the opportunity to fine tune the study processes.

The feasibility report ("NIHR HTA INTERVAL Dental Recalls Trial — A Feasibility Study and Follow-on — PHASE 1 (Feasibility Study) — Internal Pilot Trial — Investigators' Report") was submitted to the HTA on 1 March 2011 and itemised 10 amendments or alterations to trial processes, including a proposed altered schedule for PHASE 2 (Main Trial). This submission carried the approval of the Trial governance committees (TSC and DMEC). No changes to the underlying research question, trial design or trial targets were identified, required or requested. Additionally the Feasibility Report incorporated explicit statements of support for PHASE 2 from the Chief Dental Officers of Scotland, England, Wales and Northern Ireland, also asserting the importance of the evidence for dental recall policy that PHASE 2 will provide. The response from the HTA to the submitted report was received on 20 June 2011 with a request for some clarifications provided to them by the Investigators on 8 July 2011. Indication of approval and the availability of full funding for PHASE 2 was received on 16 August 2011, confirmed on 7 September 2011.

The duration of PHASE 2 is 70 months [**AMENDMENT 1 of 10.**]

**INTERNAL PILOT STUDY**

A sample of 10 practices with a target of 520 patients was involved in the feasibility study. The specific issues addressed were:

1. **Demonstrating the ability to recruit and work with "non-home" Practices.**
2. **Clarification of the procedures for setting up the trial in such a way that feasibility and acceptability can be demonstrated.**
3. **Specification of success criteria for trial feasibility in this setting.**
4. **Possibility to recruit into all three of the trial arms set out in the Commissioning Brief.**

### 1. Demonstrating ability to recruit "non-home" Practices

For the feasibility study, in order to achieve a realistic assessment of how a definitive trial would work, a random selection of practices across Scotland was identified and the ten participating practices drawn at random from this list. To preclude motivational bias, practices having any association with an applicant were not used.

In England and Wales the intended organisation for the generation of practice lists (NHS Business Services Authority) was unable to support research activity during 2009–2010 and approaches were made conventionally through research-active groups. For the Main Trial the requirement to recruit from "non-home" practices will not be applied and it is intended that recruitment of practices throughout the four nations will achieved through research-active groups. [**AMENDMENT 2 of 10**.]

**2. Clarification of the procedures for setting up the trial in such a way that feasibility and acceptability can be demonstrated.**

The procedures employed will implement the study design as outlined in the following Sections which were intended to apply to both the *feasibility phase* and the *follow on.* Amendments to process arising from the feasibility study or suggested by it are identified explicitly in text e.g. **AMENDMENT xx of 10**. Specific aspects which were intended to help demonstrate feasibility and acceptability include:

- Dentist-related issues
    - Recruitment – experience with the recruitment rates achieved in the feasibility phase will inform the strategies used in the follow on. We did not anticipate any difficulty, given that we were seeking 10 practices for feasibility and a further 34 practices for the follow on study out of a potential UK total of some 9,000 practices.
    - Retention – monthly contact was made with the recruited Practices and information on the number of practices retained from the start of patient participant recruitment was maintained.
- Practice Manager-related issues
    - The Practice Manager (and equivalent staff) are key to the long term success of the trial. Regular contact by phone and face to face visits by the study researcher was used to monitor the local administration of the trial.
- Patient-related issues
    - The recruitment process outlined in Section 3.3.13 was followed. At the recruitment appointment the dentist will discuss the trial with the potential participant and answer any questions. Those who state they do not wish to take part at this stage will then receive their check-up as normal and the reason for their non-participation noted where a reason was provided, and specific note taken if objection resided in the potential allocation to 24 month recall. This usefully informed the number of patients who might need to be approached for the follow on trial. A list size of 2000 adult patients for each dentist would indicate that sufficient numbers are readily achievable.
    - Retention was assessed by attendance at recall appointments.
- Data collection
    - Response rates to postal questionnaires was monitored by the Trials Office and reported to the Trial Steering Committee.
    - Baseline clinical outcomes was collected to estimate the standard deviation of the outcomes and hence inform any subsequent sample size calculations.

Following analysis of the clinical outcomes data it was determined that no alterations were required to the sample size calculations and therefore no changes to practice or patient recruitment targets are required for PHASE 2 (main trial).

**3. Specification of success criteria for trial feasibility in this setting.**

Success will relate to recruitment and retention of both dentists and patient participants and fidelity of observance of the protocol. It will be judged by:

- The ability of the trial team to recruit 10 (non-own) dentists at random from the whole study area and retain 8 for the duration of the feasibility phase (retirement from practice excepted). In previous trials, the applicants have experienced this level of retention, or better, over 3-5 years.

10 (non-own) dentists were recruited of which none have withdrawn, thus retaining all patients recruited during the feasibility study for follow-up and final clinical assessment.

Final clinical assessment of patients recruited during PHASE 1 will necessarily take place during the final year of PHASE 2 after a time exceeding 48 months, the intended follow-up period. This alteration to process raises no issues of patient safety: progression of dental disease is low, therefore this extension will neither compromise the measurement of the clinical outcomes nor place patients at risk. This extension has been approved by the Trial Steering Committee and Data Monitoring and Ethics Committee . [**AMENDMENT 9 of 10.**]

- Whether the dentists are able to recruit the required number of patients based on the sample size required. If the number of patients required to be screened to meet the inclusion criteria is more than 258 per dentist this would cast doubt on the feasibility of proceeding to a 3-arm trial. In this case the possibility of proceeding to an alternate 2-arm trial (risk-based vs. 6-monthly) would be discussed or there could be an increase in the number of dentists recruited.

In no case during the feasibility study was it necessary to approach more than 258 patients (the maximum number approached at one practice was 150) and PHASE 2 is proceeding with the 3-arm two-stratum trial design as originally envisaged.

- The dentists' fidelity to the trial protocol and adherence to the respective recall time to which each patient has been allocated.

Dentists' fidelity to the protocol and to the intended recall allocation was measured as intended by monitoring of patient visits. The Feasibility Report contained full details of dentists and patient recruitment and retention using the framework described above.

**4. Possibility to recruit into all three of the trial arms**

No patient is randomised to the 24 month fixed recall interval if the dentists do not deem them suitable. For the avoidance of doubt we proposed a two stratum trial design to overcome ethical considerations and potential clinician concerns. The HTA Commissioning Brief stipulated " a three arm randomised controlled trial to compare dental recall intervals of 6 months (traditional) vs. Risk based (as suggested in the NICE Guideline) vs. 24 months (the longest interval permitted in the NICE Guideline)." In addition we monitored the proportion of patients allocated to stratum 1 (the three arm trial) and the initial retention of those randomised to 24 month recall. No requirement was identified to adjust the 24 month recall to a "maximum acceptable" interval or to proceed with a two arm **follow-on** trial [fixed 6 month recall interval vs. risk based recall interval]; any such finding would have been very valuable in this evidence-deficient area of routine practice.

## FOLLOW-ON STUDY

### 3. Planned investigation

### 3.1 Research objectives

The aim of this study is to investigate whether fixed-period 24 month or risk-based recall intervals are more effective and cost effective in maintaining oral health than the traditional fixed-period six month recall.

***The primary objective*** is to compare measures of health related quality of life (as measured by OHIP-14) and oral health/disease control (as measured by periodontal disease experience), for dentate adults experiencing different recall intervals for a period of four years.

***The secondary objectives*** will compare the effect of different recall intervals on oral health/disease control (as measured by caries disease experience) the provision and use of dental services (process of care including preventive and interventive care), on patients' anxiety, satisfaction with care, oral health knowledge, attitudes and behaviours.

### 3.2 Existing research, service and policy implications

The lack of evidence for the effect that different recall intervals have on patient outcomes, provider workload and healthcare costs is causing considerable uncertainty for the profession and patients, particularly following the General Dental Council guidance for team working responsibilities around recall intervals (1) and despite the publication of the NICE Guideline (2). Current evidence suggests the most frequent pattern of adult dental attendance is annually, with 80% of adults visiting a general dental practitioner at least once during a six year period (3). The need for primary research has been highlighted in the HTA systematic review of routine dental checks (4) which found little evidence to support or refute the practice of encouraging 6-monthly dental checkups in adults. The more recent Cochrane review on recall interval found only one trial, which was assessed as having a high risk of bias, with 185 participants and concluded there was insufficient evidence to draw any

conclusions regarding the potential beneficial or harmful effects of altering the recall interval between dental check-ups (5). The limited evidence from recent observational studies also supports the need for research. Evaluation of the Canadian Non-Insured Health Benefits (NIHB) program found clients with more 'regular' check-ups received a standard pattern of service but incurred greater expenditure than those with longer gaps between recalls (6). Recent evidence from the Dutch health system suggests an increase in General Dentists applying an individualised recall interval from 49% in 2000 to 61% in 2005 and that these dentists provide more frequent periodontal screening than those using a fixed recall interval (7).

Many Primary Care Trusts (PCTs) in England are now seeking to secure adherence to the NICE recall interval guideline as part of their clinical governance responsibilities when commissioning dental primary care services. However, the lack of direct evidence behind differing recall strategies complicates the adoption process, while uncertainty remains within PCTs and among dentists as to how best to implement the guidance in practice.

### 3.3 Research Methods

#### 3.3.1 Pilot research conducted in preparation for the outline and full proposal

##### 3.3.1.1 Views of Patients

The appropriateness of using global measures of quality of life such as the oral health impact profile (OHIP) to assess subtle differences in Oral Health Related Quality of Life (OHRQoL) between two time points has been questioned (8). It is therefore necessary to develop a context specific OHRQoL measure. A series of in-depth interviews with adults in Scotland and Southern England have been conducted to investigate service users' feelings and opinions of the recall visit. The findings agree with others (9;10) in that users commented that the dental recall visit provided: reassurance, "I feel quite secure that there's nothing going too wrong"; increased confidence – "it just gives you a sense of confidence, self-confidence and well-being" and allowed people to compare their present oral heath with their previous oral health status – "recently it's been fine … but I had a kinda stage when a lot of things were going wrong but it's stabilised and now everything's fine."

##### 3.3.1.2 Views of Dentists

Pilot work, prior to the outline submission, found that dentists' main anxiety was that for some patients a 24-month recall interval could well be detrimental to oral health and would result in a breach of their professional duty of care. Consequently, they would not be willing for these particular patients to take part in the trial, due to the possibility that they would be randomised to the 24-month group. The percentage of patients thought to fall into this category varied according to the socio-economic location of the dentist's practice and ranged from 0% to 100%. On average dentists estimated that 75% of their patients would be unsuitable for randomisation to the 24-month group.

##### 3.3.1.3 Feasibility of recruitment of dental practices

In preparation for this proposal and in order to demonstrate our ability to recruit, we have surveyed our UK collaborators in current primary care research to gauge willingness to take part in a trial of this nature. Dentists from 48 practices confirmed in writing that they would be interested in taking part The willingness of dentists to be recruited to this study indicates the relevance and importance of this research. For the purposes of the feasibility study, only practices having no previous association with any of the applicants will be used and dentists will be picked at random from the study area.

#### 3.3.2 Design

This is a UK multi-centre, parallel-group, randomised controlled comparison of three recall intervals – 24-month fixed-period recall, risk-based recall (as suggested in the NICE guideline on Dental Recall), and 6-month fixed-period recall.

#### 3.3.3 Setting

Fiftygeneral dental practices across the UK. Participating dentists will represent a cross-section of practitioners operating in a range of different circumstances (e.g. urban or rural settings, high, middle or low income

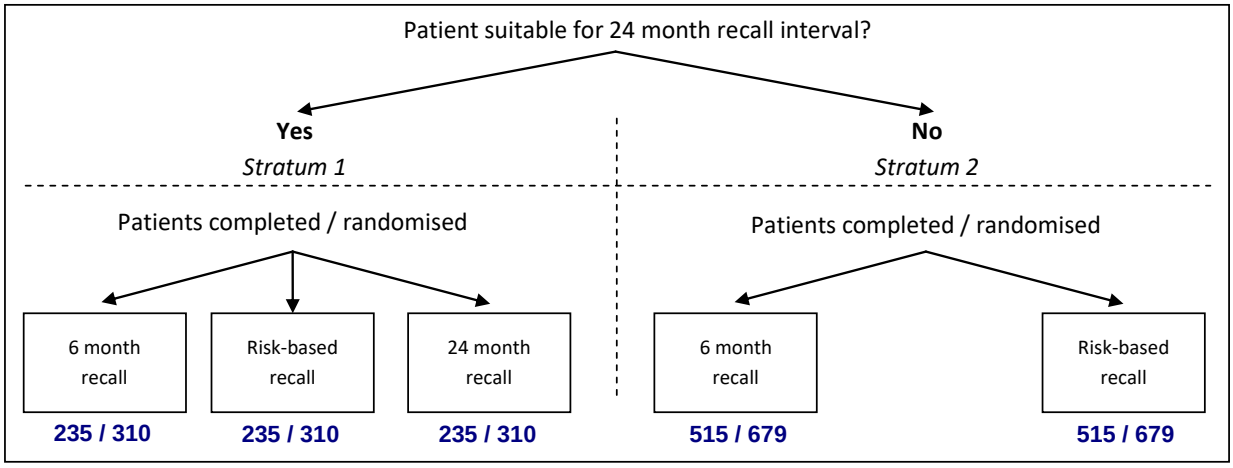
communities, fluoridated (Birmingham, Newcastle-upon-Tyne) or non-fluoridated (Scotland, Wales, Northern Ireland, NW England) water. All will be providing some NHS dental services for adults. The target recruitment is for 50% of dentists to be in Scotland and 25% to be in water fluoridated areas.

### 3.3.4 Recall Strategy Allocation

Prior to randomisation, all patient participants will be clinically examined by their dentist to determine suitability (yes/no) for randomisation to the 24-month arm (Section 3.3.1.2). A detailed risk assessment is not part of this suitability examination and the decision made will be based on current practice, with routine examination criteria and record keeping.

Randomisation will be organised within two strata: 1) 24-month fixed-period recall vs. Risk-Variable-Adjusted-Length recall vs. 6-month recall and 2) Risk-Variable-Adjusted-Length recall vs. 6-month fixed-period recall - depending on dentists' preparedness to randomise a patient participant to the 24-month arm. Randomisation will be carried out using the automated central randomisation service at the Centre for Healthcare Randomised Trials (CHaRT) at the University of Aberdeen. The design is summarised in the graphic below. The design shows the completion and recruitment targets (completed / randomised) for each recall allocation in each stratum (i.e. 1735 completed patients from a total of 2288 recruited; recruitment estimated at 52 patients at each of 44 practices).

As a consequence of running the feasibility study, it has been discussed and approved by trial governance committees and the HTA that more than one dentist per practice can recruit into the trial (**AMENDMENT 3 of 10**); furthermore, where capability and capacity are established, practices can recruit more than 52 patients into the trial (**AMENDMENT 5 of 10**).




*[See section 3.3.10 for details of sample size]*

A cluster randomised trial design was considered but rejected for several reasons. Firstly, there was no obvious mechanism for contamination to occur. Secondly, our experience of simultaneously conducting an educational cluster and patient randomised trial in dentistry suggested that contamination occurred in at most 15% of participants (if any) (11), therefore fewer participants are required to perform a patient randomised trial than a cluster randomised trial (12). Thirdly, there is no perceived direct influence of skill on the patient outcomes and, even if that were hypothesised, the intra cluster correlation would be very low (<0.03).

### 3.3.5 Inclusion/Exclusion Criteria

Inclusion:

adult patients (≥ 18 years of age) who:

- are dentate
- have visited their dentist in the previous two years
- receive their dental care as an NHS patient

Exclusion

- patients who have a medical condition indicating increased risk of bleeding or immuno-compromised

### 3.3.6 The Planned Trial Interventions

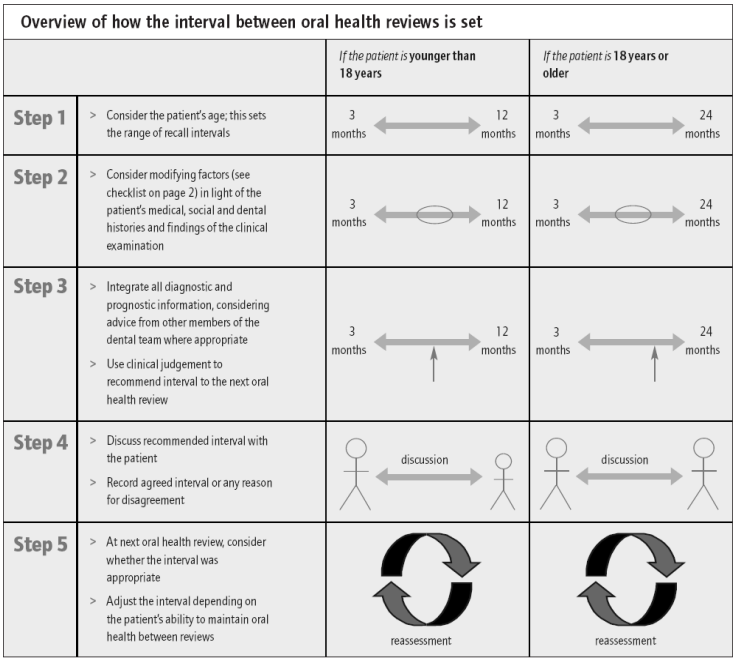
The trial interventions are three recall intervals – a fixed-period extended 24-month recall interval, a Risk-Variable-Adjusted-Length recall interval based on the NICE Guideline and a fixed-period conventional 6 month recall interval.

#### 3.3.6.1 Fixed-period recall intervals (24-month, 6-month)

Patient participants allocated to the extended 24-month recall interval and the conventional 6-month recall interval groups will attend their dentist at the scheduled time intervals for a 'routine' dental check-up. The content of this check-up will remain as per current practice. A recognised definition of a 'traditional' NHS dental check-up is clinical examination, advice, charting including monitoring of periodontal status and report (4). For patients allocated to the fixed-period recall groups dentists will provide routine care using their current system for examination, record keeping and providing advice.

#### 3.3.6.2 Risk-Variable-Adjusted-Length recall interval (NICE Guideline)

Patient participants allocated to the risk-based recall interval group will attend their dentist at time intervals determined by the evidence-based process outlined in the "2004 NICE guideline on Dental Recall" (2). The essential steps of the procedure and the risk factors collected at recall examinations are outlined (from the Guideline) in the two figures below.




| Risk Factor variables from the NICE Dental Recall "Checklist" |
|---|
| **Medical History** |
| **Social History** |
| **Dietary Habits** |
| **Exposure to fluoride** |
| **Clinical Evidence and Dental History** |
| Recent and previous caries experience |
| Recent and previous periodontal disease experience |
| Mucosal lesions |
| Plaque |
| Saliva |
| Erosion and tooth surface loss |

The recommended stages in establishing the appropriate recall interval are:

1. **Establishing the Age Range –** establishing the individual patient's age. In the case of this trial all patients will be adults of 18 years of age or more.

2. **Consideration of Risk Variables –** identification of the pertinent risk and protective factors present for each patient from the checklist and the Comprehensive Oral Health Examination, leading to the evaluation of the impact of these factors in the context of the patient's past levels of oral health and current disease experience and then, consideration of a likely range of recall intervals.

3. **Integration and Prediction of Recall Need -** use of all of the information obtained by the dental team in order to predict the potential level of threat to maintaining oral health and controlling disease for this patient and, from this, to judge the most appropriate next recall interval.

4. **Discussion** – to explicitly discuss the recommended recall interval with the patient, explain the influencing factors in setting the recall and record the agreed interval (or any reason given by a patient in disagreement).

5. **Review -** at each check-up review (oral health review), the appropriateness of the just-concluded interval is reviewed by dentist and patient and the recall interval is reset according to the experience from the last period along with any change in the risk and protective variables identified at re-examination.

   The frequency of recall interval appropriate for an individual patient will depend on the likelihood that specific diseases or conditions may develop or may progress beyond the control of secondary prevention. The guidance (built on extensive consensus methods and the limited evidence available) indicated that the recall interval range should vary from 3 to 24 months, according to risk. The information collected to identify the risk and protective factors will be standardised by using *Comprehensive Oral Health Examination* (COHA) forms. These COHA forms have been developed iteratively; piloted and modified by a DHSRU team led by the Principal Investigator in collaboration with a) the Department of Health in England - where forms were developed and tested under the scrutiny of a Clinical Advisory Group within the *Oral Health Assessment Clinical Pathway Development Project* (13) and then tested in Modernisation Agency Field sites and b) with NHSScotland where forms have been developed and piloted and are being developed further under the *Scottish Dental Clinical Effectiveness Programme* (14). The COHA history and clinical charting forms include all variables identified by the NICE guideline as potential modifying factors (risk variables) to influence the setting of recall intervals. The COHA incorporates a successfully piloted form of the NICE dental recall checklist to assist the evaluation and prediction of risk.

   The selection of an appropriate recall interval for a patient is a multifaceted clinical decision that involves judgment and cannot be decided mechanistically. The checklist information is intended to be used as a guide to assist the dentist and team in setting an appropriate recall interval. It is not an exhaustive list of all factors that may influence the choice of a recall interval for a patient. There is insufficient evidence to assign a 'weight' to individual factors in the checklist and dentists must use their clinical judgement to weigh the risk and protective factors for each patient. Training in the completion and interpretation of forms will be provided. Each year, via a web-link, they will be asked to participate in a different re-training and self-test exercise to promote continuing adherence to the NICE guidance in setting Risk-Variable-Adjusted-Length recall intervals.

   It is anticipated that by carrying out a comprehensive history and Comprehensive Oral Health Examination the dentist will be better informed to provide an accurate risk assessment and more appropriate preventive and interventive treatment recommendations (including advice) and that this will lead to improvements in maintaining oral health, in quality of life and will result in less dental anxiety for the patient. It is envisaged that, once trained and familiar with the COHA forms, the time taken to complete this process will be twenty minutes for the first risk-setting visit and fifteen minutes for subsequent recall examinations (oral health reviews). The frequency and type of oral health supervision, including advice, needed by a patient depends on the likelihood that specific diseases or

conditions may develop or may move beyond a constrained stage. Throughout the trial both the content and the time taken to complete these 'recall examinations' will be measured through trial data sheets completed by the dental team and through patient self-reports.

### 3.3.7 Outcome Measures

The outcome measures have been selected to reflect the impact of varying dental recall intervals on the modern and holistic definition of oral health specified by HTA in the background to the commissioning brief "Oral health can be defined as the state of the mouth and associated structures where disease is contained, future disease is inhibited, occlusion is sufficient to masticate food and the teeth are of socially acceptable appearance." This gives a broader, more preventive and patient focussed context than most previous studies or reviews in the area and reflects the combined primary and secondary preventive approach underpinning the NICE guidance.

**Primary outcome measures**

There are two primary outcomes: the primary clinical outcome is periodontal disease as measured by gingival bleeding, and the primary outcome relating to patient experience is quality of life as measured by the OHIP-14. These are the outcomes that the study is powered at 80% to detect meaningful changes. Other measures are collected as secondary outcomes. Given the complex intervention and the unknown correlation between the two different dimensions of the study (patient and clinical), the study will not correct the p-value for multiplicity of tests.

- Oral health/disease control
    - Periodontal disease - gingival inflammation/bleeding
- Health related quality of life
    OHIP-14

**Secondary outcome measures**

- Patient-centred
    - dental anxiety
    - oral health related knowledge, attitudes, and behaviours
    - use of and reason for use of dental services (including symptoms and pain)
    - satisfaction with care
- Oral health – disease control
    - Caries experience – assessed at both the enamel and dentine thresholds
    - Preventive and interventive care
    - Periodontal - 1) ) periodontal pocket depth 2)Calculus, present or not

- Service Providers
    - Dentist attitude towards recall strategies
- Economics
    - Cost benefit and cost-effectiveness

### 3.3.8 Proposed duration of intervention

The intervention period will be four years from the date of recruitment, and this will apply to both Phase One and Phase Two participants The appointments will be made within three or four months either side of the Year 4 anniversary of the participant's recruitment.

### 3.3.9 Proposed frequency and duration of follow-up and how outcome measures will be assessed

**Patient Centred Outcomes**

An annual self-administered postal questionnaire will be used to measure the primary and secondary patient centred outcomes. The questionnaire will include:

- A global assessment of quality of life using short form oral health impact profile (OHIP-14) (8)
- A standardised measure of health outcome (EQ 5D) to enable cost utility analysis.
- Dental anxiety status (15;16) using recognised and validated psychological inventories.
- Oral health related knowledge, attitudes and reported behaviours.
- Problems experienced (e.g. pain, lost fillings and fractured teeth), need for emergency access or referral to secondary care, treatment received from an alternative dentist.
- Satisfaction with dental care.

Following PHASE 1 feedback, the density of questions in the Annual Patient Questionnaire has been reduced. This has been achieved without compromising data quality or completeness. For clarity, the questionnaire has been re-titled from "Annual Questionnaire" to "Annual Patient Questionnaire". [**AMENDMENT 7 of 10**].

**Clinical Outcomes**

All clinical outcomes will be assessed at four years by trained examiners who are blinded to allocation. After considerable debate and consultation it was decided that the use of trained, blinded examiners to conduct a baseline clinical outcome assessment conferred no added value to the interpretation of clinical results from the trial. However, for the internal pilot study patients in two practices underwent a clinical examination to estimate the standard deviation of the clinical measures and hence inform any subsequent sample size adjustments. Gingival inflammation and bleeding at the gingival margin are transient symptoms that respond quickly to changes in oral hygiene behaviour therefore there it is inappropriate to measure change over four years. A trial of this duration would be unlikely to detect clinically significant change in clinical attachment level because this occurs so slowly. At the dentinal level caries also progresses slowly and incremental change is difficult to quantify, in part, because of the amount of treatment for non-caries associated restorations. Although traditionally calibration of examiners has been undertaken in dental epidemiological studies and some trials, current expert opinion is that this is inappropriate (Professor M Gilthorpe, personal communication).

**Caries Measurements** of caries experience will be made using the validated International Caries Detection and Assessment System (ICDAS) (17-19). The caries detection elements of the ICDAS criteria (and their forerunners) are now well tested and are advocated for general use, for use in the clinical trial arena and in dental epidemiology (20;21). The ICDAS criteria measure both early and more advanced stages of caries. For early caries, ICDAS measures the surface changes and potential histological depth of carious lesions by relying on surface characteristics related to the optical properties of sound and demineralised enamel prior to cavitation. The primary requirement for applying the ICDAS system is the examination of clean and dry teeth aided by a ball-ended explorer that is used to remove any remaining plaque and debris and to check for surface contour, minor cavitation or sealants. All surfaces of all teeth will be examined and the status of each recorded in terms of caries and restorations. This system allows the recording of both preventive and operative care needs.

**Periodontal** Gingival inflammation as bleeding will be measured according to the Gingival Index of Loe (22) by running a UNC periodontal probe circumferentially around each tooth just within the gingival sulcus or pocket. After 30 seconds, bleeding will be recorded as being present or absent on the buccal and lingual surfaces. The colour-coded UNC periodontal probe will be used to measure periodontal pocket depth and the presence of calculus. Clinical outcomes will be measured for all teeth (excluding third molars) at 6 sites per tooth [mesiobuccal, midbuccal, distobuccal, mesiolingual/palatal, midlingual/palatal, and distolingual/palatal]. The sequence of scoring will be gingival inflammation/bleeding, periodontal pocket depths and calculus (present or not). The periodontal examination will take place first, then teeth cleaned and caries examination carried out.

**Other secondary outcome measures**

- **Preventive and Interventive Care** Throughout the follow on phase of the Trial, for each patient the dentist and dental team will complete a specially designed form to capture dental treatment provided including scheduled and re-scheduled dental check-up appointments. Details of treatment not included in

the forms will be captured through the routinely collected data held by Information Services Division (ISD) in Scotland and NHS Information Centre in England.

### 3.3.10 Proposed sample size

This trial has considered three patient-centred primary outcome measures, quality of life (QoL), caries and periodontal health/disease. Consideration of which primary outcome measure to use for the sample size calculation was as follows: 1) Validated quality of life measures in dentistry are not considered sensitive enough to detect the expected impact of different recall strategies because they have been designed to discriminate between groups with more gross and acute differences in oral health than we would expect e.g. the impact on QoL of the loss of several teeth. (25) 2) Caries progression at the dentinal level in a group of dental attending adults is slow (26) and we predict any difference due to recall strategy would be small and not clinically relevant at 4-year follow up. Whilst we anticipate a difference at the enamel level (i.e. white spot lesion, ICDAS) between recall groups, there is little data from an adult population to determine the sample size of this trial. However, we consider the recent developments and experience in the recording of enamel caries to be very important and we have taken this into consideration when determining the sample size. 3) Periodontal disease is so unpredictable and slowly progressing that a clinically relevant difference in attachment level would not be expected or detectable. However, the absence of bleeding on probing is a patient observed health outcome, a reliable indicator of periods of periodontal disease stability (27) and a risk indicator of caries inactivity (28). Clinically significant differences in gingival bleeding would be expected with different recall strategies and data are available from previous studies in the same population for the sample size calculation.

Bleeding on probing was chosen as the outcome measure for the sample size calculation however, consideration was also given to what we might detect in QoL and enamel caries. Our sample size calculations indicate we need to randomise 705 participants to stratum 1 (235 in each arm) and 1030 to stratum 2 (515 in each arm). Within the feasibility stage, baseline clinical and patient questionnaire data were used to estimate the standard deviations of the primary clinical outcome and patient based outcome measures. This informed the likely size of effect we will be able to detect and was used to determine whether we need to increase or decrease the sample size to detect dentally meaningful changes. No changes were implied or implemented by these interim calculations. In addition, the throughput of eligible patients for each stratum will determine the likely number of practices required in the main trial and the number of patients required to be screened per practice.

*Comparison 1*: Risk-based vs. 24-month & *Comparison 2*: 6 months vs. 24 month: The sample size for these will be calculated for patients in stratum 1. An exploratory trial in a similar population reported 35% of gingival sites were bleeding on probing (standard deviation of 25%). Although little is known to guide plausible effect sizes for different recall intervals, there is however some evidence that 6-monthly scale and polishing versus no scale and polishing reduces bleeding sites by 15% (5). The recall interval would be expected to produce an effect lower than this given that the majority of participants in all arms will still be receiving a scale and polish at some time during follow up. Assuming either risk-based vs. 24-month or 6-month vs. 24-month could reduce/increase the proportion of sites bleeding by 7.5%, a study with 235 in each arm could detect such a difference with 90% power at 5% significance, and likewise detect a difference of 0.3 of the standard deviation of the OHIP-14 or any other global measure of QoL. For the caries clinical outcome, assuming a standard deviation of 3.5 a study with 235 participants per arm could detect a shift in white spots lesions (from 3.3 to 4.2) at 80% power and 5% significance (21) *Comparison 3*: Risk-based vs. 6-month: We can combine the two strata, without introducing bias, to estimate this comparison. We anticipate smaller effect sizes for this comparison than 6 monthly versus 24 monthly given that many of the participants in the risk-based group will be seen more frequently than 24 months. A study with 750 participants in each arm could detect a difference in bleeding scores of 4.5% at least 90% power and 5% significance level, and likewise detect a difference of 0.17 of the standard deviation of the OHIP-14. For the caries clinical outcome, assuming a standard deviation of 3.5 a study with 750 participants per arm could detect a 20% relative shift in white spots lesions from 3.3 to 3.9 at 90% power and 5% significance (21).

As described in section 3.3.4, we see no reason to be concerned about contamination effects in this trial or clustering by dentist, however, the sample size has been conservatively estimated such that if contamination

occurred with 15% of the control participants or the intra cluster correlation was 0.03, the study would still have 80% power to detect the hypothesised changes in the bleeding score.

### 3.3.11 Statistical analysis

The patient participant outcomes listed in 3.3.9 will be compared between 24-month recall, risk based recall and 6-month recall groups using generalized linear models adjusting for the minimisation covariates and other covariates felt to be of prognostic importance. Statistical significance will be at the 2.5% level and corresponding confidence intervals will be derived. All participants will remain in their allocated group for analysis (intention to treat). Subgroup analyses will explore the possible effect modification of a number of factors including age, social class, residence in a fluoridated area, dentist characteristics (e.g. professional engagement, workplace stress) all using stricter levels of statistical significance ($p<0.01$). All trial analyses will be according to a statistical analysis plan that will be agreed in advance by the Trial Steering Committee (TSC). The Data Monitoring and Ethics Committee (DMEC) will meet at 9, 24, 36 and 48 months to review progress and recommend any responses to divergences from planned trial design. In development of any new context-specific dental recall HRQoL measure, the reliability and construct validity of the measure will be assessed using Confirmatory Factor Analysis (CFA) (27) and to test the measurement properties of latent variables believed to define the multi-dimensional construct of quality of life specific to dental recall.

### 3.3.12 Economic evaluation

A full economic evaluation will be performed to assess the cost-effectiveness of the different recall strategies. Both a cost-utility analysis (incremental cost per Quality Adjusted Life Year (QALY) and cost-benefit analysis (net benefits) will be performed. The perspective will be the NHS and the patient. Resource use estimates will be combined with unit costs obtained from standard sources and study specific estimates. For the cost-utility analysis, QALYs will be derived from the responses to the EQ-5D in the patient annual questionnaire.

The economic analysis will assess whether fixed-period 24-month or risk-variable-adjusted length dental recall represents a cost-effective use of NHS resources compared to the traditional fixed-period six-month recall. Cost-effectiveness will be measured in terms of the incremental cost per quality adjusted life year (QALY) gained and in terms of net benefits.

1 Benefits

Two measures of benefit are used: Quality Adjusted Life Years (QALYs) and Willingness to Pay.

1.1 Quality Adjusted Life Years (QALYs)

Quality of Life is measured using the EQ-5D instrument. EQ-5D is a standardised instrument for use as a measure of health outcome. It classifies patients into one of 243 health states (5 dimensions, each with 3 levels). The five dimensions are: mobility; self-care; usual activities; pain/discomfort; and anxiety/depression. The EQ-5D data collected are translated into 'utility scores' using the UK population tariff (Dolan, 1995). The scores represent an index score where 0 represents death and 1 represents full health. The EQ-5D scores are measured at baseline, 1 year, 2 years, 3 years and 4 years as part of the Patient Questionnaire. QALYs are estimated by estimating the area under the lines that link the utility scores obtained at the different time points. In case of any baseline differences in the EQ-5D scores, regression analysis is used where patient specific QALYs are modelled as a function of the baseline EQ-5D score and arm of the Trial. The coefficient of arm of the trial represents the QALY differences adjusted for baseline differences.

1.2 Willingness to Pay

QALYs are unlikely to capture all relevant benefits in this study. The recall strategies are likely to vary in terms of non-health outcomes, such as level of reassurance, as well as health outcomes. It is crucial to incorporate the non-health outcomes into the economic analysis as they are likely to be important to patients. The benefits of the recall strategies are therefore valued in monetary terms (willingness to pay values). A Discrete Choice Experiment (DCE) is used to estimate the willingness to pay values for the different recall strategies. The DCE presents individuals with a series of choices between different scenarios which vary in terms of frequency of

routine check-ups, risk of oral health problems, and cost. The DCE will be administered to a separate sample of the public obtained from electoral rolls over the course of the Trial.

A key strength of the economic design is that preferences will be elicited from a separate sample representative of the general public rather than the trial participants. The majority view within the health economics field is that the public's preferences should be used within economic evaluation. In a publicly funded system such as the NHS the resources are provided by the public and therefore the way resources are allocated should reflect their preferences, it should reflect the value that the general public place on the service. This is also the view held by NICE. To ensure representativeness in terms of socio-demographics and to avoid any potential biases introduced by trial participation, it is crucial that the DCE is administered in a separate sample.
The sample size required reflects the need for the sample to be larger than the number of independent variables; provide an adequate sample for each pre-determined subgroup e.g. dental attendance (regular, non-regular), non-smoker or current smoker; socio-economic status (high, medium, low), (12 subgroups in total and 30-100 per subgroup (Pearmain et al., 1991)) and accommodate the expected non-response rate (40%). Allowing for individuals to be present in a number of groups, the questionnaire will be sent to 1000 individuals ([12x50]x[100/60]). The questionnaire will be anonymous and two reminders will be sent to all respondents (to maintain anonymity). This sample will be checked to ensure it is representative. Conditional logistic regression analysis is used to model the preference as a function of the attributes. Marginal rates of substitution between the coefficients of the attributes and costs represent willingness to pay. Bootstrapping is used to obtain confidence intervals surrounding the willingness to pay values.

## 2 Costs

It is assumed that health service use other than dental care is the same across the arms of the Trial. Firstly, the intervention can be perceived as a screening mechanism. Dental treatments and therefore health outcomes are less likely to vary across the different arms compared to say an intervention that consists of an actual treatment. The use of health services is less likely to differ as a result. Secondly, although evidence does suggest that there are correlations between periodontal disease and coronary heart disease, the association is relatively small and occurs over relatively long time periods. Given the size and time horizon of the Trial, it is highly unlikely that any potential differences in co-morbidities can be measured.

The perspective of the analysis is the NHS and the patient. The cost categories to be included are: NHS costs of the intervention; costs of dental treatment other than check-up; and patient costs.

### 2.1 NHS Costs of the Intervention

The cost of the interventions includes time taken to conduct the check-up and procedures conducted during check-up. These data are collected through the Trial data sheets to be completed by the dentists. The cost is estimated by combining these data with the dental and patient fees from the Statement of Dental Remuneration. An estimate of the training costs for risk-variable-adjusted-interval recall will be estimated using expert judgment.

### 2.2 Costs of Dental Treatment Other than Check-up

The costs of all dental treatment provided to patients other than the planned check-ups are captured through the routinely collected data held by Information Services Division (ISD) in Scotland and NHS Information Centre in England. Consent to obtain information from these national databases for the participant has been obtained through the Patient Consent form. The level of detail in the national databases varies across England and Scotland. The Scottish data contain information on over 400 different treatments. The English and Welsh data contain information on 19 treatment categories. The cost is estimated by combining these data with the dental and patient fees from the Statement of Dental Remuneration.

### 2.3 Patient Costs

The recall strategies vary in terms of the frequency of dental visits. This has clear implications for the costs that patients may incur. Participant costs will comprise two main elements: travel costs for making return visit(s) to the dentist; and time costs of travelling and attending the dental appointment. Data on these costs are collected

at baseline through the Patient Questionnaire. The participants are asked how long they spent travelling to and attending the dental appointment. Participants will also be asked what activity they would have been undertaking (e.g. paid work, leisure, housework) had they not attended. These data will be presented in their natural units, e.g. hours, and also cost estimates using standard economic conventions, e.g. the Department of Transport estimates for the value of leisure time. The travel expenses will include the cost of either personal or public transport used. The costs are assumed to be the same for all visits.

The Patient Questionnaire asks participants whether they usually pay for dental care (which may vary between and within countries). For those who do pay, patient fees from the Statement of Dental Remuneration will be used to estimate the average cost over the Trial.

The quantity, unit cost and average cost per participant will be reported. Regression analysis will be used to adjust for baseline differences. Bootstrapping is used to obtain confidence intervals surrounding the average cost estimates.

3 Cost-effectiveness

The incremental cost per QALY is estimated by dividing the difference in mean total costs by the difference in QALYs between the arms of the Trial. This ratio can be compared to the conventional threshold of £30,000 per QALY. Bootstrapping is used to generate Cost-Effectiveness Acceptability Curves (CEAC). The CEAC shows the probability that the different recall strategies are cost-effective compared to usual care at various thresholds of cost-effectiveness. The threshold represents the decision-maker's willingness to pay for an additional QALY. The CEAC represents the joint uncertainty surrounding the cost and QALY pairs.

The willingness to pay values are directly compared with the costs to produce net benefits. If the willingness to pay values are greater than the costs, then it can be concluded that there is a positive net benefit. The recall strategy with the highest net benefit is the most efficient option. Whether this recall strategy should be implemented depends on the financing system. If the service is financed privately and the values are elicited from service users, then the service will be provided if the net benefit is positive. If the service is financed through a public system, the service will compete with others services because of a fixed budget. Whether the service will be provided will then depend on the size of the net benefit. A net benefit curve is produced which shows the probability of the net benefits being larger than the thresholds.

4 Missing Data

Missing data are expected as patients may withdraw from the Trial before reaching the end period and/or may fill out the Patient Questionnaire incompletely. The extent of the problem would depend on the nature and pattern of missing data. Two approaches will be used to deal with any missing data. The data will first be analysed using complete cases only. This may lead to biased and incorrect results if a relatively large proportion is missing. Multiple imputation using iterative chained equations is therefore also used to impute missing values. Data are imputed at each time point based on an iterative algorithm, imputing 5 datasets, adjusting for baseline characteristics. Data will be predicatively mean matched to fit within the range of the available data.

5 Sensitivity Analysis

Several one-way sensitivity analyses will be performed. Univariate sensitivity analysis is used to examine the impact of the discount rate, uncertainty surrounding the unit cost data, missing data, centre-specific variation.

### 3.3.13 Practical arrangements for identifying and allocating participants to trial groups

*Identifying potentially eligible patient participants*:

Recruitment of dentists:

Dentists will be recruited through research-active groups in Scotland, England, Wales and Northern Ireland.

*Recruitment of patients:*

Recruitment of patients will be achieved through standard procedures and agreements for primary care research in the four nations. In Scotland co-ordinators from the Scottish Primary Care Research Network (SPCRN) will assist practice staff managing previously scheduled appointments, by including promotional material and an invitation to participate, in the appointment letters. The text of the letter has previously been approved, only the mechanism of delivery is altered. [**AMENDMENT 4 of 10**]. In Wales, England and Northern Ireland appropriate regional CLRNs will provide the identical service. The Trial Office (TO) in Dundee will not have access to any data prior to the patient consenting to take part in the trial. At this stage patients who clearly express no interest in taking part will be sent an alternative check-up appointment to see their dentist. At the recruitment appointment the dentist will discuss the trial with the potential participants and answer any questions. Those who state they do not wish to take part will then receive their check-up as normal. Eligibility of those who express an interest in taking part will be confirmed against pre-defined criteria. Those who are eligible will then sign the consent form. The dentist will then examine the patient participant for suitability for randomisation to the 24 month arm.

*Randomisation:* Patient participants' allocation to the recall interval trial groups will use the automated central randomisation service at the Centre for Healthcare Randomised Trials (CHaRT), University of Aberdeen, with access by telephone 24/7/52. Allocation will take place after the suitability examination. Eligible participants will be randomised in equal proportions within each of the two strata according to a minimisation algorithm including dentist, age, Filled Teeth - FT (FT≤8 or FT>8 (31)) and absence of gingival bleeding on probing. There will be separate, identical algorithms for the 2 strata.

### 3.3.14 Monitoring compliance of intervention

Previous studies carried out by the research team have demonstrated that dentists comply with protocols and patient compliance has been excellent (11;30;32). Compliance with the allocated recall interval will be measured through dental attendance information provided both by the practice and the patient participant. Provision of preventive advice as part of the check-up visit will be quantified using practice data collection/records and confirmed by the patient self administered annual questionnaire. Dentists who appear to be diverging from the protocol will be contacted by the trials office and training will be provided as required. We have evidence that 70% of dentists and 65% of patients perceive a 'routine' check-up to take no more than 10 minutes to complete and we anticipate that the risk-based recall will take 15-20 minutes to complete. We will consider systematic deviations from these time estimates as a signal to contact the dentists to discuss compliance with the protocol (32).

### 3.3.15 Proposed methods for protecting against sources of bias

Dentists will be responsible for the recruitment of patient participants who will then be allocated at random to recall interval group. The suitability examination will minimise the potential risk of selection bias arising from dentists' unwillingness to recruit patients considered unsuitable for 24-month recall. To avoid the risk of post selection bias potential patient participants will be identified in advance of recruitment and recall interval allocation using the primary care networks in Scotland, England, Wales and Northern Ireland. A centralised, secure randomisation service will be used. Clinical outcomes assessment at the end of the trial will be conducted by trained outcome assessors blinded to allocation. For participating dentists the provision of web based self tests will be supplemented by annual local training sessions to discuss the content and delivery of the risk-based recall strategy. To reduce missing data, an automated system for co-ordinating reminders and arranging recall appointments will be set up. The trial statistician will be blinded to allocation for the final analysis.

### 3.3.16 Likely Rate of Loss to Follow-Up

In the power calculation we have assumed a loss to follow-up for dentists of 10% based on the observed rates of 12% and 9% in two recent large, multi-centre practice based RCTs. (11;30). For patient participants it is anticipated that loss to follow-up will be not more than 15% at 4 years. This estimate is based on a practice based trial conducted in North-West England where 79% of 4211 participants were retained for a period of 5 years (34). In a recent trial conducted in a similar population 78% of participants returned a follow-up postal questionnaire (11). In this trial we anticipate a lower loss to follow-up because we will be using a more intensive

reminder system and will explore the use of evidence based strategies to improve response. To help minimise attrition all participants [dentist and patients] will receive trial marketing materials [e.g. calendars, key rings, greeting cards, pens, mouse mats etc.] at regular intervals. A regularly updated trial website and Newsletters will be set up. For dentists, annual local meetings will be held where they can meet with the research team and other participating dentists. The TO will be in regular contact with practices to maintain enthusiasm. For patient participants recall reminders will be followed up by personal communication from the TO and patients' costs will be reimbursed.

### 3.4 Ethical arrangements

Informed signed consent will be obtained from the participants. The trial will be coordinated from a centre with experience of multicentre trials, cognisant of the implications of research governance and other legal frameworks for the conduct of trials. This is not classed as a trial of any investigational medicinal products or procedures, and so does not come under EU Clinical Trials Directive. We will continue to conduct the study to the standards required by the NHS Universities Research Governance Framework as well as all other applicable legal, ethical and regulatory requirements. Arrangements for independent supervision are as described later in this document.

### 3.5 Risks and anticipated benefits for trial participants

The design of the study ensures that adults for whom a 24-month recall interval may be detrimental are not put at risk of allocation to this group. Periodontal disease and caries progress very slowly. During the trial participants will be monitored, possibly more frequently than they might otherwise have been; also patients may receive more preventive advice. It will be made clear to patients, and dentists, that patients may attend at anytime if there is a need for a dental appointment between recall visits. These patients will not be withdrawn from the trial. No dental treatment including referral to specialist services will be withheld from patients as a result of taking part in the trial.

### 3.6 Independent supervision

The Trial Steering Committee (TSC) includes an independent Chairperson (Edwina Kidd, Emeritus Professor of Cariology, Kings College London), other independent members, include Professor E Treasure and Professor J Steele and a consumer representative will oversee the trial. The TSC will also comprise a selection of the co-applicants including the Principal Investigators (Pitts and Clarkson), the trial statistician (Ramsay) and the Director of CHaRT. There will only be two voting members drawn from any of the co-applicants. The TSC will meet annually throughout the course of the study. The Data Monitoring and Ethics Committee (DMEC) met early in the trial to agree its terms of reference and other procedures. The DMEC will continue to report any recommendations to the Chair of the Steering Committee.

### 3.7 How will the results of this trial be used?

The results of this trial will be disseminated widely and actively through professional, primary care, public and scientific routes. Results will be communicated directly to all participating dental practices and an open workshop will be held with them discussing the next steps in getting the findings of the study to influence clinical practice. The trial results will be used to inform ***policy*** (through targeted feedback to all of the UK Health Departments and the British Association for the Study of Community Dentistry and its Consultants in Dental Public Health Group); ***practice*** (through specific communications to NICE, the British Dental Association and the Faculty of General Dental Practice (UK)); ***the public*** (through INVOLVE and patient organisations) as well as with dental education and training (through a range of communications to postgraduate dental Deans, the undergraduate dental schools.

Given the current dearth of directly applicable evidence around this important research question, it is anticipated that the impact of this trial will also be felt at the International level as well as closer to home (specific presentations will be made to the International Association for Dental Research and its Evidence Based Dentistry Network as well as to organisations such as the European Association for Dental Public Health and related European specialty societies for research and practice.

## 4. Project management timetable and milestones

***Arrangements for day to day management of the trial*** The trial will be co-ordinated from the Trial Office (TO) in the Dental Health Services Research Unit, Dundee, and will provide day to day support for the dental practices. CHaRT, Health Services Research Unit, Aberdeen University, will provide the database applications and IT programming for the TO, host the randomisation system, provide experienced trial management guidance and take responsibility for all statistical aspects of the trial (including interim reports to the TSC and DMEC). The TO will be responsible for transacting the randomisation, collecting all trial data (including postal questionnaires), co-ordination of patient participant appointments, follow up and data processing. The dental practice will be responsible for recruiting participants (including initiating the randomisation call). An Operations Management Committee, led by the Trial Manager, will meet weekly in the early stages at the TO to ensure smooth running of the trial, trouble-shooting issues as they arise and ensuring consistency of action across the participating centres. CHaRT staff in Aberdeen will join this group as required, weekly by teleconference and in person every 4-6 weeks. These face to face meetings will become less frequent as the trial progresses successfully, and increase again in frequency as the trial enters its closedown phase. A Trial Management Committee will meet bi-annually and be chaired by the Principal Investigators and include all the co-investigators and key members of the TO and CHaRT. Their remit will be to oversee the progress of the trial, and they will report to the TSC.

***Timetable and Milestones***

The timetable for the main trial is 1 September 2011 – 28 February 2019 (70months) as follows:

| | | |
|---|---|---|
| 12 months | Sep 2011 – Feb 2014 | Practice and patient recruitment |
| 12 months | Sep 2012 – Mar 2018 | Patient follow-up and final clinical assessment |
| 6 months | – Mar 2018 Feb2019 | Analysis and dissemination |

| | | |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

## 5. Expertise

The applicants are an experienced, multi-disciplinary team who have a strong track record of successfully conducting national (Scotland) and across-national (UK) multi-centre, practice based trials and of meeting the challenges in securing the necessary ethical and NHS R&D approvals. The group has internationally acknowledged experts in all facets of the trial and includes experienced trialists from a variety of backgrounds who have successfully worked together in previous studies. Nigel Pitts, joint lead applicant, is Director of the Dental Health Services Research Unit (DHSRU) and chaired the NICE Guideline Development Group on Dental Recall. He has also led a team developing the Department of Health, England *Oral Health Assessment Clinical Pathway* (designed to integrate with the NICE Recall Guideline) and *Oral Health Assessment for NHSScotland*. Additionally he is an internationally acknowledged expert in cariology and is co-chair of the International Caries Detection and Assessment System (ICDAS) co-ordinating committee and is a member of the National Institutes for Health funded US Practice Based Research Network "PEARL". Jan Clarkson, joint lead applicant, is Professor of Clinical Effectiveness, Programme Director in Effective Dental Practice within DHSRU, Director of the Scottish Dental Practice Based Research Network (SDPBRN) and Director of the Scottish Dental Clinical Effectiveness Programme (SDCEP). She was also part of the NICE Guideline Development Group (along with Helen Worthington and Ian Needleman) and contributed to the Cochrane Systematic Reviews of evidence in this field along with Helen Worthington.

Professor Worthington is a Director of Research at the University of Manchester and is an internationally renowned expert in the field of dental statistics. Further expertise in this area comes from Craig Ramsay who is a Senior Statistical Research Fellow at the Health Services Research Unit in Aberdeen and Linda Young who is Guidance Development Researcher with the Scottish Dental Clinical Effectiveness Programme. Marjon van der Pol, Director of the Economic Evaluation Programme at the Health Economics Research Unit in Aberdeen will bring expertise in the trial aspects related to health economics. Expertise relating to Dental Care Professionals and Patients respectively is brought by Margaret Ross, a Senior Lecturer within the Edinburgh Dental Institute and Eleanor Grey. Eleanor Grey was chair of the Faculty of General Dental Practice (UK) Lay Advisory Group, was part of the NICE Dental Recall Guideline Development Group and is currently working with NICE on technology assessment.

The team has a proven track record in recruitment of clinicians and patients to primary care based research trials and cohort studies. The UK-wide existing collaboration between co-applicants with Jan Clarkson and Linda Young's involvement in the SDPBRN minimise the risks associated with this trial. Deborah White, a consultant in dental public health in Birmingham brings expertise in recruiting practices and has been involved in the conduct of the UK decennial Child and Adult dental health surveys for many years.

Ruth Freeman is Professor of Dental Public Health Research and Programme Director of Oral Health and Health Research at DHSRU. She has experience of both qualitative and quantitative research methodologies which has allowed her to develop and evaluate the reliability and validity of oral health-related quality of life inventory and questionnaires assessing oral health-related knowledge, attitudes and behaviours. Ronald Gorter is an associate Professor at the University of Amsterdam who has expertise on the measurement of dentist burnout and engagement with patients. Gerry Humphris is Professor of Health Psychology at the University of St Andrews and is an expert on in depth psychometric analysis of new quality of life measures and dental anxiety. Debbie Bonetti is a health psychologist in DHSRU who has extensive experience in interviewing patients and clinicians, developing and analysing questionnaires and applying psychological models in primary care research. This range of specialist expertise is required to refine qualitative outcome measures for this trial and to exploit the potential of these data.

In the field of cariology Nigel Pitts is joined by Gail Douglas (formerly Topping), formerly Programme Director of Dental Caries Control research at DHSRU, Professor of Dental Public Health at Leeds Dental Institute and co-ordinator to the ICDAS research and development core group. As such she has been actively engaged in the development and use of the ICDAS coding system since its inception 5 years ago. The education and continuing professional development expertise of this company (Smile-on) was utilised to produce a training pack for practices to understand and apply the NICE recall guidance to allocating risk based recall intervals to patients, and for them to refresh and update their knowledge throughout the period of this trial. In the field of periodontology, Ian Needleman is Senior Lecturer/Honorary Consultant at the Eastman Dental Institute with

wide experience in designing and conducting clinical trials in this area. He provided content expertise on the periodontal component to the NICE Dental Recall Guideline as well as an exhaustive systematic review on professional mechanical plaque removal for the European Federation of Periodontology. Additional expertise comes from Penny Hodge, a clinical lecturer in periodontology at the University of Glasgow Dental School who also works part-time in specialist practice.

## 6. Service users

The quality of the RCT will be greatly enhanced by involving the public with the advantages including improvements to the planning and focus of the research, public perspective on the study, advice on ethical issues and direct experience of the issue under review. DHSRU is well placed to realise these advantages as member of the Health Informatics Centre (HIC) which has an established track record of working with the public and has built connections with local Public Partnerships Groups (PPGs). These independent groups comprise volunteers who work in partnership with NHS Tayside and aim to provide a conduit for the views of people on their local services. Researchers within HIC have harnessed the services of these PPGs on a variety of research topics and the PPGs also played an active role in a major HIC dissemination and publicity project "Health in the Information Age".

The public perspective on the TSC will be provided by Mrs. Eleanor Grey. Advice on the design and conduct of the study will be sought from members of the PPGs and from similar patient groups in other parts of the UK sourced under guidance from INVOLVE. These patient advisors will be a valuable resource not only at the outset of the trial but throughout its duration and will help ensure good conduct and patient friendly practice. As quality of life is a primary outcome of the trial, patients' input to the proposed questionnaire design is considered essential. Qualitative work with patients will be carried out to ensure that the outcome measures are patient-centred. The questionnaire will subsequently be piloted with patient groups in different parts of the UK.

**Justification of support required**

The Trial Office (TO) at DHSRU will comprise a full time Senior Research Fellow responsible for the day to day running of the trial, ensuring effective communication between all centres, service users and the sponsor, a full time Trial Administrator to support the TO and to assist in project managing the study to ensure it runs smoothly and on time, a secretary to facilitate meetings, co-ordinate data entry and all related secretarial duties. Ahead of the actual Trial commencing a part time DHSRU Administrator who will facilitate the recruitment of the SCR, Trial Administrator and Secretary as well as arranging to process the application for ethical approval. The TO will be supported by staff at CHaRT and HERU as described in Section 5 (Expertise). This team of experts will take overall responsibility for ensuring the trial meets GCP standards, providing guidance to the TO, ensuring the smooth delivery of all IT aspects of the trial, randomisation, application for web data entry and trial databases. The Statistician will assist with all statistical aspects including the production of progress reports for the TSC and production of the data for dissemination including publications. The key researchers across the scientific disciplines involved will also advise and participate in statistical data analysis.

## 8. References

(1) Medical Defence Union. Dental Recall Intervals - a matter of clinical choice. Available from http://info.the-mdu.com/I?a=A9X7Cqg,LZ598S5bAqLSljPjTA. Accessed February 2007.

(2) National Health Service. National Institute for Clinical Excellence Guideline: Dental Recall: Recall interval between routine dental examinations. London; NICE; 2004 Available from www.nice.org.uk/CG019NICEguideline Accessed February 2007.

(3) Tilley CJ, Chalkley MJ. Measuring access to health services: General Dental Services in Scotland. Br Dent J 2005; 199(9):599-601.

(4) Davenport C, Elley K, Salas C, Taylor-Weetman CL, Fry-Smith A, Bryan S et al. The clinical effectiveness and cost-effectiveness of routine dental checks: a systematic review and economic evaluation. Health Technol Assess 2003; 7(7):iii-127.

(5) Beirne PV, Clarkson JE, Worthington HV. Recall intervals for oral health in primary care patients. Cochrane Database of Systematic Reviews 2007, Issue 4. Art. No.: CD004346. DOI: 10.1002/14651858.CD004346.pub3.

(6) Leake JL, Birch S, Main PA, Ho E. Is regular visiting associated with lower costs? Analyzing service utilization patterns in the first nations population in Canada. J Public Health Dent 2006; 66(2):116-122.

(7) Mettes TG, van der Sanden WJ, Mulder J, Wensing M, Grol RP, Plasschaert AJ. Predictors of recall assignment decisions by general dental practitioners performing routine oral examinations. Eur J Oral Sci 2006; 114(5):396-402.

(8) Slade GD. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol 1997; 25(4):284-290.

(9) Gibson BJ, Drennan J, Hanna S, Freeman R. An exploratory qualitative study examining the social and psychological processes involved in regular dental attendance. J Public Health Dent 2000; 60(1):5-11.

(10) Wyrwich KW, Tardino VM. Understanding global transition assessments. Qual Life Res 2006; 15(6):995-1004.

(11) Clarkson JE. The effectiveness of enhanced oral health advice and instruction upon patient oral hygiene, knowledge, and self-reported behaviour. Chief Scientist Office. 2005.
(12) HTA. Measuring contamination effects in trials of educational interventions. In Press.
(13) Hally JD, Pitts NB. Developing the first dental care pathway: The oral health assessment. Primary Dental Care 2005; 12(4):117-121.
(14) Scottish Dental Clinical Effectiveness Programme. Oral Health Assessment and Review. Guidance in Brief. NHS Education Scotland . 2011.
(15) Humphris GM, Morrison T, Lindsay SJ. The Modified Dental Anxiety Scale: validation and United Kingdom norms. Community Dent Health 1995; 12(3):143-150.
(16) Humphris GM, Freeman R, Campbell J, Tuutti H, D'Souza V. Further evidence for the reliability and validity of the Modified Dental Anxiety Scale. Int Dent J 2000; 50(6):367-370.
(17) Pitts NB, Stamm JW. International Consensus Workshop on Caries Clinical Trials (ICW-CCT)--final consensus statements: agreeing where the evidence leads. J Dent Res 2004; 83 Spec No C:C125-C128.
(18) Ismail AI. Visual and visuo-tactile detection of dental caries. J Dent Res 2004; 83 Spec No C:C56-C66.
(19) Ismail AI, Sohn W, Tellez M, Amaya A, Sen A, Hasson H et al. The International Caries Detection and Assessment System (ICDAS): an integrated system for measuring dental caries. Community Dent Oral Epidemiol 2007; 35:170-178.
(20) ICDAS Coordinating Committee. International Caries Detection and Assessment System (ICDAS) Coordinating Committee (2005). Rationale and Evidence for the International Caries Detection and Assessment System (ICDAS II). In: Stookey GK, editor. Clinical Models Workshop: Remin-Demin, Precavitaion, Caries: proceedings of the 7th Indiana conference. Indianapolis, USA.: 2005: 161-221.
(21) Chesters RK, Pitts NB, Matuliene G, Kvedariene A, Huntington E, Bendinskaite R et al. An abbreviated caries clinical trial design validated over 24 months. J Dent Res 2002; 81(9):637-640.
(22)Loe H. The Gingival Index, the Plaque Index and the Retention Index Systems. J Periodontol 1967; 38(6):Suppl-6.
(23) Loe H, Silness J. Periodontal disease in pregnancy. Prevalence and severity. Acta Odontol Scan 1964; 21:533-551.
(24) Ramfjord SP. Indices for prevalence and incidence of periodontal disease. J Periodontol 1959; 30:51-59.
(25) Slade GD. Assessing change in quality of life using the Oral Health Impact Profile. Community Dent Oral Epidemiol 1998; 26(1):52-61.
(26) Pitts NB. Monitoring of caries progression in permanent and primary posterior approximal enamel by bitewing radiography. Community Dent Oral Epidemiol 1983; 11(4):228-235.
(27) Neely AL, Holford TR, Loe H, Anerud A, Boysen H. The natural history of periodontal disease in man. Risk factors for progression of attachment loss in individuals receiving no oral health care. J Periodontol 2001; 72(8):1006-1015.
(28) Ekstrand KR, Bruun G, Bruun M. Plaque and gingival status as indicators for caries progression on approximal surfaces. Caries Res 1998; 32(1):41-45.
(29) Kline R. Principles and practice of structural equation modelling. New York, USA: The Guildford Press, 1998.
(30) The effect of remuneration and education on the implementation of research evidence to reduce inequalities in oral health. Final report. 2006. Edinburgh, UK, Chief Scientist Office.
(31) Office for National Statistics. Adult dental health survey. Oral health in the United Kingdom 1998. 2000. London, UK, The Stationery Office.
(32) Bonner BC, Young L, Smith PA, McCombes W, Clarkson JE. A randomised controlled trial to explore attitudes to routine scale and polish and compare manual versus ultrasonic scaling in the general dental service in Scotland [ISRCTN99609795]. BioMed Central 5[3]. 23-6-2005.
(33) Topping GVA. Secondary Caries Misdiagnosis: An in vitro study in premolar and molar teeth restored with amalgam and Conjoint Analysis of patients' and dentists' preferences for attributes of a caries diagnosis device. 2001.
(34) Clarkson JE, Worthington HV, Davies RM. Restorative treatment provided over five years for adults regularly attending general dental practice. J Dent 2000; 28(4):233-239.