Journal of Clinical Periodontology
Official Journal of The European Federation of Periodontology
Founded by the British, Dutch, French, German, Scandinavian, and Swiss Societies of Periodontology

J Clin Periodontol 2008; 35 (Suppl. 8): 67–82 doi: 10.1111/j.1600-051X.2008.01261.x

Systematic Review

The cost-effectiveness of supportive periodontal care for patients with chronic periodontitis

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Gaunt F, Devine M, Pennington M, Vernazza C, Gwynnett E, Steen N, Heasman P. The cost-effectiveness of supportive periodontal care for patients with chronic periodontitis. J Clin Periodontol 2008; 35 (Suppl. 8): 67–82. doi: 10.1111/j.1600-051X.2008.01261.x.

Abstract

Objective: To systematically evaluate the evidence for effectiveness of supportive periodontal care (SPC) provided in specialist care and general practice for patients with chronic periodontitis; to construct a model for the cost effectiveness of SPC.

Search Strategy: Electronic database searches of MEDLINE, EMBASE and SCOPUS were performed with hand searching of relevant journals and Workshops of Periodontology.

Selection Criteria: SPC for patients with chronic periodontitis, at least 12 months follow-up and clinical attachment level as a primary outcome.

Results: Three articles addressed the question (Nyman et al. 1975, Axelsson & Lindhe 1981, Cortellini et al. 1994): Δs CAL for patients undergoing ''specialist'' SPC were 0.1 mm (2 years), 0.2 mm (6 years) and −0.01 mm (3 years) respectively. In generalist care the Δs CAL during SPC were −2.2, −1.8 and −2.8 mm. Differences between specialist and generalist SPC were an extra 20.59 tooth years and 3.95 mm attachment loss for generalist SPC. Incremental cost-effectiveness ratios were an extra €288 for one tooth year or an extra €1503/1 mm reduction in loss of attachment for SPC delivered in specialist care.

Conclusion: SPC delivered in specialist as compared with general practice will result in greater stability of clinical attachment but this will be achieved at relatively greater cost.

Key words: chronic periodontitis; cost effectiveness; maintenance; supportive periodontal care

Accepted for publication 20 May 2008

The long-term stability of successfully treated chronic periodontitis demands the introduction of, and compliance with a definitive and frequent programme of supportive periodontal care (SPC) (periodontal maintenance) (Lindhe & Nyman 1984, Wilson et al. 1991). Indeed, SPC must be regarded an integral part of overall periodontal management (American Academy of Periodontology 2000, Cohen 2003) and the universal aims of such a programme are to:

- Prevent the recurrence and progression of periodontal disease in patients who have been previously treated for gingivitis, periodontitis or peri-implantitis;
- prevent or reduce the incidence of tooth loss by monitoring the dentition and any prosthetic replacements for the natural teeth;
- increase the probability of locating and treating in a timely manner, other disease and conditions of the oral cavity (Committee on Research, Science and Technology of the American Academy of Periodontology 1998).

The ultimate success of SPC has been identified and reported through a number of long-term, retrospective, population studies which have unequivocally demonstrated that whether in university, hospital or specialist practice settings, only 2–5% of teeth in patients originally treated for chronic periodontitis are lost over periods of between 5 and 10 years (Wilson et al. 1987, Wood et al. 1989, Loesche et al. 2002, Fardal et al. 2004, Chambrone & Chambrone 2006) and that the majority of the extractions tend to be in a minority population of high-risk patients (Tonetti et al. 2000, Chambrone & Chambrone 2006).

Conflict of interest and source of funding statement

The authors declare that they have no conflict of interests.
This review has been self-supported by the authors and Newcastle University.
The 6th European Workshop on Periodontology was supported by an unrestricted educational grant from Straumann AG.

Clearly, there are considerable demands on facilities and manpower of periodontal specialists and their dental hygienists if they are to provide the definitive SPC for all their patients. In reviewing service provision in private practice, Nevins (1996) suggested that such demands must necessitate careful selection of patients at risk who will be managed in the long-term in the specialist environment. An obvious strategy for sharing the burden of providing SPC is to delegate some provision of care to the referring general practitioner and hygienist. This would seem a reasonable approach given the observations made in a survey of periodontal services rendered by 600 general dental practitioners in Virginia, USA: In particular, that 50% of dentists provided SPC on a regular basis and 58% reported that 90% of scaling and root instrumentation was undertaken by one or more hygienists at the practice (Lanning et al. 2007). Furthermore, as general dentists develop interests in periodontics through continuing education programmes (Lanning et al. 2007) and as dental hygienists and therapists become more prevalent in the general dental services, then there may be a greater willingness to provide elements of the non-surgical retreatment modality that is often required over and above the normal SPC (Fardal & Linden 2005).

Objectives

The objectives of this review were to:

- systematically evaluate the evidence for effectiveness of, and clinical outcomes during SPC provided in specialist and general dental practice for patients with a history of chronic periodontitis;
- narratively assess evidence from papers that compare effectiveness of SPC provided in specialist and general dental practice but which were excluded from the systematically acquired evidence;
- construct a hypothetical model for the cost-effectiveness of SPC when delivered in specialist and general dental practice.

Material and Methods

(Note: all terminology referred to in the text of this review is as reported in the original articles. There is, therefore, reference to curettage and root planing rather than root instrumentation.)

Development of protocol

The protocol was developed *a priori* and covered all aspects of review methodology: rationale, design, focused question, inclusion and exclusion criteria, search strategy, quality assessment and data synthesis. The protocol was peer reviewed by institutional colleagues with experience of undertaking systematic reviews.

Focused question

The focused question, which was constructed according to the recognized PICO format, read:

''What is the effect of supportive periodontal care in specialist practice *versus* general dental practice in terms of clinical and economic outcomes for patients with a history of chronic periodontitis?''

Criteria for including studies in the review

The protocol recognized that randomized, controlled (RCTs) and controlled clinical trials (CTs) are the most appropriate designs to address a focused question that embraces effectiveness of interventions. Nevertheless, because our previous systematic review of SPC revealed no randomized controlled trial (Heasman et al. 2002) it was decided *a priori* to include both experimental (randomized controlled trials, controlled trials, quasi-experimental trials) and observational studies (cohort studies, before and after studies, time series studies) in the hierarchy of evidence for this review (Khan et al. 2001).

The study selection criteria were studies:

- of SPC following surgical and non-surgical treatment in specialist and, or general care;
- with at least 12 months follow-up;
- of patients with chronic periodontitis (or alternative diagnosis);
- with clinical attachment level as a primary outcome measure.

Specific exclusion criteria were studies:

- of preventive regimes for populations;
- where the frequency of SPC is not reported;
- where the frequency of SPC is $\geqslant 12$ months;
- of patients with aggressive periodontitis (or alternative diagnosis);
- of patients with only gingivitis;
- which do not report attachment level as an outcome measure;
- where there is no reference to either the treating or supervising clinician or the site (practice/hospital/university) where the SPC is delivered.

Search strategy

Electronic database searches of MEDLINE, EMBASE and SCOPUS, and the Cochrane Oral Health Group Specialty Trials' Register were performed up to and including September 2007 using MeSH terms and keywords. The details of the search histories for MEDLINE and EMBASE are given in Appendix A. Scopus was searched using the following search terms and strategy: Periodontal OR chronic periodontitis OR perio$ AND maintenance OR maintenance therapy OR supportive OR follow up treatment AND PUBYEAR AFT 1965. Hand searching was performed of the *Journal of Periodontology*, *Journal of Periodontal Research*, *Journal of Clinical Periodontology*, *European Workshops of Periodontology* (1994, 1997, 1999, 2002, 2005), *World Workshops of Periodontology* (1989, 1996) and Special Editions of the *Journal of Dental Research* (2005–2007). The Editors-in-Chief of the *Journal of Periodontology*, *Journal of Periodontal Research* and *Journal of Clinical Periodontology* were contacted by email to identify manuscripts that may have been either submitted for publication or in press at the time of the search. A further paper that had been submitted for publication was requested following a presentation at the UK Restorative Dentistry Pan Society meeting in Birmingham in 2007. Authors and researchers were contacted directly to seek clarification regarding ambiguous issues or missing data whenever possible. The searches were confined to identifying full text articles written in the English language.

Validity assessment

The titles and abstracts were screened in the first instance by two reviewers (F. G. and P. A. H.). Disagreement was resolved both by discussion and by the decision of a third reviewer (M. D.) under which circumstances the majority view was respected. Full texts of potentially relevant studies were obtained and reviewed independently by two

reviewers (F. G. and P. A. H.) for inclusion and disagreement was resolved by discussion; the same reviewers undertook data extraction. The methodological quality assessment of the studies included in the review was assessed by F. G. and M. D. Data extraction and quality assessment were undertaken using specifically designed appraisal forms that were piloted on a small number of studies before being used for the full texts. Inter-reviewer agreement scores for titles and abstracts, full text articles and methodological quality assessments were calculated with 2×2 or 3×3 contingency tables and reported as κ statistics [95% confidence intervals (CI)].

Assessment of methodological quality

The following criteria were used to assess the quality of the included studies:

RCTs

(i) *Randomization* was classified as being: adequate, when a random numbers table, tossed coin or shuffled cards were used; inadequate, when other methods of randomization were used (alternative assignment, hospital number, date of birth); unclear, when the method was not reported or explained.

(ii) *Allocation concealment* was classified as being: adequate, when examiners were not aware of the randomization sequence (central randomization, sequential numbers, opaque envelopes); inadequate when other methods were used (alternative assignment, hospital numbers, odd/even, date of birth); unclear when the method was not reported or unexplained.

(iii) *Blinding of examiners* was assessed on a single blinding basis (yes/no) as it was considered unreasonable to assume that patients could be blinded to the treatment they received in this type of trial.

RCTs and other trial designs

(iv) *Completeness of follow-up* was assessed using the following questions to which the response was yes or no:

- Was the number of patients at baseline and at completion of the trial reported?
- Were all the patients who entered the trial accounted for at completion?
- Does the analysis take into account drop-outs and losses to follow-up or the excluded patients?

(v) *Compliance* of the patients to the SPC regime was determined as having been reported (yes) or unreported (no).

(vi) *Sites* used for data recording – full mouth, part mouth or target teeth.

It is conceivable that self-selection bias will be a factor in any long-term follow-up study of SPC as those patients who are more motivated and compliant are perhaps more likely to complete the study and thus form a non-representative sample. We considered that bias towards self-selection could not be evaluated. An evaluation of the potential for selection bias was undertaken with respect to allocation concealment of randomization in the three studies with test and control groups. The reported numbers of drop-outs and whether or not an exit strategy was adopted were also addressed in all 14 studies.

Data management and analysis

Titles and abstracts from the electronic searches were managed by downloading to EndNote software. EndNote 9 was used to import the reference data and to manage the imported references. The purposely designed data extraction forms recorded study title, authors, type of study, randomization and blinding if relevant, treatment phase, details of the SPC, clinical outcomes of tooth loss and change in clinical attachment level during SPC, statistical findings, conclusions and the criteria used to assess study quality. With respect to attachment change, the differences in means between the start of SPC and the final time point of the observations were deduced and presented in tabulated form. In view of the immense heterogeneity of study design, periodontal treatments, observation points and methods of reporting data, it was felt that a meta-analysis was inappropriate.

Cost-effectiveness evaluation of SPC

The cost-effectiveness analysis was conducted from the perspective of a single patient over a 30-year time period. The primary, patient-based outcome was tooth years lost with clinical attachment loss as the secondary outcome (because teeth lost are likely to be more relevant to the patient). Tooth years lost is more relevant than teeth lost, as it also includes time as a factor, so that a tooth lost after 1 year would equate to 30 tooth years lost over the full evaluation period. Data for the two outcomes were taken from the article of Axelsson & Lindhe (1981) and extrapolated on a linear basis over a 30-year period. Although the cohort that received SPC in specialist care showed a gain in clinical attachment, to simplify the model, this is taken as periodontal stability.

Costs were also evaluated from a patient perspective, and these were based on patient charges from one specialist practice in the North East region of England (Paterson 2008) and on State Health Service patient charges in Scotland (NHS Scotland 2007). Additionally, costs of lost work time were estimated using average hourly earnings in the United Kingdom (Office of National Statistics 2007) multiplied by an estimate of appointment and travel time. Travel costs are not included.

Events that may incur a cost during SPC were loss of a tooth (with possible prosthetic replacement) and periodontal retreatment. The possible outcomes for tooth loss that were considered in the evaluation were extraction alone, extraction and replacement with a resin retained bridge, extraction and replacement with a removable prosthesis and extraction and replacement with an implant. It was assumed that patients would have these provided by general dentists on health service (State) care with the exception of implants which are more likely to be provided on a private basis. Estimates of the percentage of patients choosing each of these options were made and the costs of providing these were taken as health service (Scottish) fees and fees from a specialist practice in North East England for the implant option. These costs were multiplied by the percentage chance of choosing each specific option and totalled to give an average cost of losing a tooth. These data were incorporated into the yearly costs by multiplying this figure by the percentage chance of tooth loss from the outcome data. To simplify the evaluation it was assumed that only SPC, rather than periodontal retreatment, would be undertaken.

The three interventions of interest were therefore:

- Provision of SPC by a specialist periodontist assuming 30-min.

hygienist appointments at a specialist practice, requiring 1 h of travelling time for the patient and with 3-monthly recall intervals;
- Provision of SPC on a State healthcare programme and assuming 20-min. hygienist appointments at a general practice, requiring 30 min. travelling time for the patient and with 6-monthly recall intervals;
- Provision of SPC by a general dentist assuming 20-min. hygienist appointments at a private practice, requiring 30 min. travelling in total and with 6-monthly recall intervals.

Costs and outcomes were both discounted at the standard rate of 3.5% annually (HM Treasury 2003). Discounting is standard economic practice and reflects time preference: that is, receiving a benefit now being preferred to receiving a benefit at any point in the future; or alternatively, a cost now is preferred less than a cost at any time in the future. This is different from inflation which is not included, so that monetary values are given in current terms.

Total costs and total benefits (outcomes) over the 30-year time period were then determined for each of the three SPC provisions. The final stage was to create an incremental cost effectiveness ratio (ICER) by examining the differences in costs and benefits between the SPC programmes being compared (in this case one ICER to compare specialist SPC with private generalist SPC, and one ICER to compare specialist SPC with health service generalist SPC). The increase in cost was then divided by the increase in benefit, to give a value for the extra cost per extra unit of benefit.

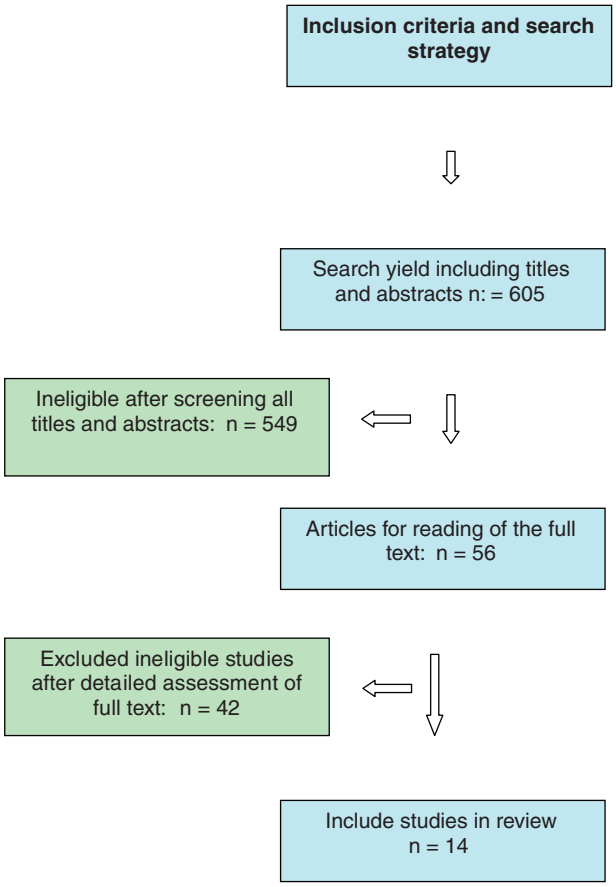

Fig. 1. Flow of articles through the review process.

Results

Search results

The flow of articles through the review is shown in Fig. 1. Our searches identified 605 articles after elimination of duplicates. Four hundred and eighty-five were retrieved from databases and 120 from hand-searching. The independent screening of the titles and abstracts led to the rejection of 549 articles. The κ statistic for agreement between reviewers for the initial screening was 0.769 (SE 0.03) [95% CI 0.709–0.828]. The full texts of the remaining 56 articles were read and a further 42 were rejected on the basis of not fulfilling the inclusion criteria set out in the protocol. The specific reasons for these exclusions are given with the references in the bibliography. Fourteen articles were, therefore, considered to be eligible for inclusion in the systematic review.

Of the articles that were excluded after full reading of the text, we identified three studies that provided potentially valuable data that we considered to be at least in part relevant to answering our focused question. For this reason, a brief narrative review of these papers is provided with the caveat that no assessment of methodological quality was undertaken.

Study characteristics

The references of the 14 studies included in the systematic review are given in the bibliography and the characteristics of the studies are reported in Table 1. The timescale of the publications was 1975–2001. All studies recruited patients to a cohort design. Two studies were considered to address the focused question directly: Axelsson & Lindhe (1981) allocated patients to either a ''recall'' group in which SPC was provided in a specialist environment or to a ''non-recall'' group in which SPC was provided (after giving written instructions) by general dentists; Cortellini et al. (1994) allocated patients to a group who received intensive SPC from a hygienist in specialist care and to a group who received more ''sporadic'' SPC from general dentists. Further, Nyman et al. (1975) allocated patients for SPC to a Test group to deliver intensive SPC for 2 years or to a control group where SPC involved a scale and polish every 6 months. The latter interventions might be considered to be consistent with SPC provided in specialist or general practice, respectively, although neither arm of the study involved general dental practitioners. The remaining 11 studies all delivered SPC in either a specialist, hospital or university (research) environment.

Of the 14 studies: four delivered SPC after hygiene phase and scaling/root planing (ScRP) (Cugini et al. 2000,

Jenkins et al. 2000, Rosling et al. 2001a, b); five delivered SPC after hygiene phase therapy and then ScRP, either alone or in combination with periodontal surgery (Pihlstrom et al. 1981, Ramfjord et al. 1987, Kaldahl et al. 1988, Becker et al. 2001, Serino et al. 2001); two studies delivered SPC after hygiene phase and periodontal surgery with guided tissue regeneration (GTR) (Cortellini et al. 1994, Weigel et al. 1995); two studies delivered SPC after hygiene phase, ScRP and periodontal surgery (Nyman et al. 1975, Axelsson & Lindhe 1981); one study in which SPC was provided after hygiene phase and then either periodontal surgery or curettage (Ramfjord et al. 1975).

The period of SPC and follow-up was variable and ranged from 1 to 12 years: 1 year (Cugini et al. 2000, Jenkins et al. 2000); 2 years (Nyman et al. 1975, Kaldahl et al. 1988); 3 years (Cortellini et al. 1994); 6 years (Axelsson & Lindhe 1981, Pihlstrom et al. 1981, Weigel et al. 1995); 5 years (Ramfjord et al. 1975, 1987, Becker et al. 2001); 12 years (Rosling et al. 2001a, b, Serino et al. 2001).

The data were presented in various formats. Five studies reported tooth loss (Axelsson & Lindhe 1981, Pihlstrom et al. 1981, Rosling et al. 2001a, b, Serino et al. 2001). One study presented data as clinical attachment change (ΔCAL) between pre-treatment and post-SPC time points (Nyman et al. 1975) whereas all remaining studies either presented ΔCAL data specifically, or in a way that enabled deduction of Δmean CALs, for the period of SPC. Two studies reported cumulative ΔCAL for buccal, lingual and approximal/interproximal sites (Ramfjord et al. 1975, Rosling et al. 2001b), eight studies reported total mean ΔCAL (Nyman et al. 1975, Axelsson & Lindhe 1981, Cortellini et al. 1994, Weigel et al. 1995, Cugini et al. 2000, Jenkins et al. 2000, Rosling et al. 2001a, Serino et al. 2001) and four studies reported ΔCAL according to both the periodontal treatment undertaken and the initial depths of the pockets as being shallow (1–3 mm), moderate (4–6 mm) or deep ($\geqslant$7 mm) (Pihlstrom et al. 1981, Ramfjord et al. 1987, Kaldahl et al. 1988, Becker et al. 2001). (Kaldahl et al. defined the categories as being 1–4, 5–6 and $\geqslant$7 mm although for the purpose of observations these were also classified as shallow, moderate and deep.)

Methodological quality of included studies

The κ value (agreement) between examiners for methodological quality where there were three possible outcomes (adequate, inadequate and unclear) was 0.944 (SE 0.06) [95% CI 0.834–1.00]. When there were only two possible outcomes (yes/no) the κ was 0.811 (SE 0.10) [95% CI 0.608–1.000]. Eight studies reported the use of a process of randomization in the study although in six of these methods were unreported and therefore unclear (Nyman et al. 1975, Axelsson & Lindhe 1981, Pihlstrom et al. 1981, Ramfjord et al. 1987, Kaldahl et al. 1988, Serino et al. 2001). Two studies reported adequate randomization as being with a ''coin flip'' (Becker et al. 2001) and a table of random numbers (Ramfjord et al. 1975). No method for allocation concealment or for upholding blindness of the clinical examiners was reported in any study. Five studies recorded clinical data using full mouth measurements (Nyman et al. 1975, Axelsson & Lindhe 1981, Kaldahl et al. 1988, Cugini et al. 2000, Rosling et al. 2001b) whereas nine studies incorporated a design that used a range of different measurement areas that were dependant upon the treatments or number of treatments being used: target teeth (after GTR) Cortellini et al. 1994, Weigel et al. 1995); non-molar teeth (Rosling et al. 2001a, Serino et al. 2001); half-mouth splits (Ramfjord et al. 1975, Pihlstrom et al. 1981, Becker et al. 2001); quadrant splits (Ramfjord et al. 1987) and target sites with probing depths $\geqslant$4 mm (Jenkins et al. 2000). All studies reported numbers of subjects and patients at baseline and at conclusion using either narrative or *n* values on graphs or in tables. Four studies failed to adequately account for drop-outs (Ramfjord et al. 1975, 1987, Pihlstrom et al. 1981, Cugini et al. 2000) and five studies failed to clearly report the method for accounting for drop-outs in the statistical analysis (Ramfjord et al. 1975, 1987, Cugini et al. 2000, Rosling et al. 2001a, Serino et al. 2001). Only two studies made reference to compliance of patients with the SPC programme (Weigel et al. 1995, Becker et al. 2001).

No study that included a method of randomization to test and control cohorts reported a method of allocation concealment. Four studies reported no drop-outs (Nyman et al. 1975, Cortellini et al. 1994, Cugini et al. 2000, Becker et al. 2001) and eight studies reported drop-outs affecting $\geqslant$20% of the original study cohort (Ramfjord et al. 1975, 1987, Pihlstrom et al. 1981, Weigel et al. 1995, Cugini et al. 2000, Rosling et al. 2001a, b, Serino et al. 2001). Three studies adopted an exit strategy of loss of attachment of $\geqslant$2 mm at sites affecting $\geqslant$4 teeth (Rosling et al. 2001a, b, Serino et al. 2001) and exit strategies of loss of $\geqslant$2 or $\geqslant$2.5 mm attachment loss were used in three further studies (Kaldahl et al. 1988, Cugini et al. 2000, Jenkins et al. 2000).

Clinical outcomes

The data extracted from the original articles are presented in Table 1. Where the original data have been reported these show means, standard errors or standard deviations for tooth loss or ΔCAL during SPC. Otherwise, the data show Δmean CAL during SPC as deduced from the original data reported in the articles.

Of the three articles that appeared to specifically address the focused question (Nyman et al. 1975, Axelsson & Lindhe 1981, Cortellini et al. 1994) the Δs CAL for patients undergoing regular ''specialist'' SPC and recall were 0.1 mm (2 years), 0.2 mm (6 years) and -0.01 mm (3 years) respectively. For those patients being managed in generalist care (or following a programme consistent with that provided in general practice) the Δs CAL during SPC were -2.2, -1.8 and -2.8 mm, respectively.

During SPC programmes of 1 year the Δmean CAL was -0.03 (Cugini et al. 2000) and -0.04 mm for the subgingival scaling group reported by Jenkins et al. (2000). In studies of longer programmes of SPC (12 years), the Δmean CAL was -0.87 (Rosling et al. 2001a), -0.80 (Rosling et al. 2001b) and -0.26 mm (Serino et al. 2001). The four studies that presented data for shallow, moderate and deep pockets followed SPC programmes of between 2 and 5 years (with 3 month recall) and all reported SPC programmes following both ScRP and modified Widman flap surgery as the active periodontal management (Pihlstrom et al. 1981, Ramfjord et al. 1987, Kaldahl et al. 1988, Becker et al. 2001). This allowed the mean and range of the expected outcomes for ΔCAL to be deduced for each of the specific cate-

Table 1. Tooth loss and change in attachment during supportive periodontal care in 14 studies of the systematic review

Study/Year	Trial design	No. of participants	Mean age (SD) range	Treatment phase	Supportive care	Clinical outcomes
Nyman et al. (1975)	Cohort	20	Unreported	OHI and surgical pocket elimination	Test group: Professional tooth cleaning every 2 weeks for 2 years. Control group: Scale and polish every 6 months	Test group: mean (SE) gain of CA 0.1 (0.25 mm) at 2 years. Control group: mean (SE) loss of CA − 2.2 (0.39) at 2 years. CAL measurements relative to presurgical measurements
Ramfjord et al. (1975)	Cohort	82	39.6 (13.1) [19–61]	OHI, ScRP followed by either: curettage OR MWF OR pocket elimination with split-mouth design	Prophylaxis every 3 months for 5 years	CAL (mm) between 1 and 5 years: Buccal / Lingual / Interproximal sites Curettage − 0.50 / − 0.65 / − 0.64 MWF − 0.26 / − 0.36 / − 0.23 Pocket elimination − 0.33 / − 0.24 / − 0.27
Axelsson & Lindhe (1981)	Cohort	90	52	OHI, ScRP followed by MWF	Recall group: 30 min. appointment for Sc and OHI every 2 months for 2 years and then every 3 months for 4 years Non-recall group: referred to dentist with written instructions for plaque control programme.	Baseline taken as 2 months after surgery Mean (SD) No. teeth Recall Baseline 19.6 (7.0) 6 years 19.4 (7.0) Non-recall Baseline 18.0 (5.0) 6 years 17.3 (5.5) Δmean CAL during 6 year period of SPC Recall +0.2 Non-recall − 1.8
Pihlstrom et al. (1981)	Cohort	17	43 [22–59]	OHI, ScRP followed by MWF for half mouth	60 min. appointments with hygienist every 3–6 months for supra and subgingival scaling for 4 years	8 teeth extracted during active therapy. 6 teeth extracted during SPC Change in mean CAL (mm) during 4 years of SPC according to initial pocket depth. ScRP / MWF 1–3 mm − 0.22 / − 0.23 4–6 mm − 0.27 / − 0.25 ⩾7 mm − 0.47 / − 0.07
Ramfjord et al. (1987)	Cohort	90	[24–68]	OHI, ScRP followed by pocket elimination, curettage, ScRP or MWF mouth, split mouth design.	Recall for prophylaxis every 3 months for 5 years	ΔCAL (mm) during SPC according to initial pocket depth PE / C / ScRP / MWF 1–3 mm − 0.53 / − 0.64 / − 0.62 / − 0.64 4–6 mm − 0.49 / − 0.42 / − 0.57 / − 0.43 ⩾7 mm − 0.26 / − 0.41 / − 0.40 / − 0.53

Kaldahl et al. (1988)	Cohort	82	43.5	Random allocation to treatment of quadrants by coronal scaling (cs), subgingival ScRP, SRP+MWF or osseous resection with ScRP	Recall with hygienist every 3 months for 2 years: ScRP in 3 quadrants. CS and prophylaxis provided to quadrant initially treated by CS.	Δmean CAL (mm) during SPC according to initial pocket depth (mm) CS / ScRP / MWF / OR 1–4: −0.33 / −0.29 / −0.34 / −1.26 5–6: −0.16 / −0.02 / −0.12 / −0.01 ⩾7: −0.25 / −0.03 / −0.06 / 0.11
Cortellini et al. (1994)	Cohort	23	[18–56]	OHI, ScRP followed by GTR at target sites of attachment loss ⩾6mm	Intensive OHI for 1 year. Then: Group A ($n = 15$) OHI, ScRP from hygienist every 3 months for 3 years. Group B ($n = 8$) Sporadic SPC from general dentist	Δmean CAL (mm) during SPC Group A: −0.01 Group B: −2.80
Weigel et al. (1995)	Cohort	24	54 [40–79]	Hygiene phase and GTR	Supragingival ScRP and rinsing with 0.1% CHX every 3–6 months for 4 years. SPC commenced 3 months postsurgery	Δmean CAL (mm) during SPC Teeth subjected to GTR: −1.05 Sites subjected to GTR: −0.94
Cugini et al. (2000)	Cohort	32	48 (11) [29–71]	ScRP	Full mouth scaling and instruction in home care at 3 monthly intervals for 12 months post-therapy	Δmean CAL (mm) −0.03 between post-treatment monitoring at 3 and 12 months.
Jenkins et al. (2000)	Cohort	39	[34–67]	ScRP	Allocated to one of two SPC regimes: Coronal scaling (CS) Subgingival scaling (SS) at 3 monthly intervals for 1 year	Δmean CAL (mm) at 12 months CS: −0.13 (0.19) SS: −0.04 (0.18) Last observation carried forward for CS loser sites ⩾2 mm LOA that required SS
Becker et al. (2001)	Cohort	16	42 [30–57]	ScRP alone ScRP & MWF ScRP & Osseous resection	Postsurgery – weekly for 6 weeks for prophylaxis, then recall every 3 months for 5 years. Details of SPC intervention not reported.	Δmean CAL (mm) during 5 years SPC relative to initial pocket depth ScRP / MWF / OR 1–3: −0.07 / −0.35 / −0.39 4–6: 0.01 / −0.72 / −0.26 ⩾7: −0.09 / −0.49 / −0.97

Table 1. (Contd.)

Study/Year	Trial design	No. of participants	Mean age (SD) range	Treatment phase	Supportive care	Clinical outcomes
Rosling et al. (2001a)	Cohort with high susceptibility to periodontal disease	170	45.5 (8.4)	ScRP	OHI and subgingival instrumentation of pockets ⩾5 mm and BoP. Recall 3–4 visits a year for 12 years	Average of 1.9 teeth/subject lost after 12 years SCP. Cumulative ΔCAL (mm) over 12 years SPC according to sites: Buccal −0.85; Lingual −0.85; Approximal −0.80; Total −0.80
Rosling et al. (2001b)	Control cohort of RCT	148	44.5 (8.6)	ScRP	Recall for prophylaxis every 3–4 months for 12 years with ScRP at sites ⩾5 mm Sites exited if CA loss ⩾2 mm at ⩾4 teeth.	Average of 2.4 teeth/subject lost after 12 years SPC. Cumulative ΔCAL over 12 years SPC = −0.87 mm
Serino et al. (2001)	Cohort	64	Unreported	ScRP only or ScRP & MWF	OHI and subgingival instrumentation of pockets ⩾5 mm and BoP. Recall 3–4 visits a year for 13 years.	Mean (SD) tooth loss during SPC: ScRP 1.6 (1.7); MWF 0.6 (1.1)
				ScRP only or ScRP & MWF		Δmean CAL (mm) during 12 years SPC: ScRP −0.26; MWF −0.25

ΔCAL, change in clinical attachment level; BoP, bleeding on probing; C, curettage; CA, clinical attachment; CHX, chlorhexidine; CS, coronal scaling; GTR, guided tissue regeneration; LOA, loss of attachment; MWF, modified Widman flap; OHI, oral hygiene instruction; OR, osseous resection; PE, pocket elimination; RCT, randomized controlled trial; SD, standard deviation; SE, standard error; SPC, supportive periodontal care.

gories of initial pocket depths and these data are presented in Table 2.

Narrative review of papers

In addition to those articles that were included in the systematic review we identified three papers that we considered should be reported in narrative review either because of their potential relevance to the focused question (Preshaw & Heasman 2005, Matuliene et al. 2008) or because of the relevance of high quality SPC data for comparative purposes (Bogren et al. 2008a). The specific reasons for the exclusion of these three articles from the systematic review are given in the bibliography.

Preshaw & Heasman (2005) recruited 35 patients with chronic periodontitis who, following non-surgical treatment were allocated randomly to a programme of SPC undertaken either in a specialist clinic or in general dental practice. SPC in the specialist clinic was delivered every 3 months and included reinforcement of oral hygiene measures, prophylaxis and root instrumentation to remove reformed calculus. Those discharged to their referring dentists were managed according to an SPC programme that was provided to the dentist in written instructions from the specialist clinic.

In each case, the period of follow-up was 1 year. Full mouth mean pocket depths remained stable over the 12 months for those receiving SPC in specialist care (3.4–3.2 mm) and general dental practice (3.1–3.0 mm). Prevalence of bleeding sites also remained stable throughout SPC for both cohorts: specialist care 41.9–44.1% of sites; general dental practice 33.1–36.7% of sites. There was no significant change in either clinical outcome at 12 months compared with the beginning of SPC. These observations were despite plaque scores having a slight tendency to increase throughout the 12 months: mean full mouth plaque index increased from 0.48 to 0.74 for specialist SPC and from 0.45 to 0.74 for generalist SPC. The researchers concluded that, at least in the short term, clinical improvements remained stable in patients receiving SPC in specialist or general dental practice and that this was despite a tendency for plaque control to deteriorate.

Matuliene et al. (2008) undertook a retrospective, cohort study in Berne to observe 171 patients following

Table 2. Mean and ranges for changes in attachment level observed in four studies reporting change according to initial pocket depth and following either scaling/root planing or modified Widman flap procedure and after 2–5 years of SPC (Pihlstrom et al. 1981, Ramfjord et al. 1987, Kaldahl et al. 1988, Becker et al. 2001)

	ScRP	MWF
Initial pocket depth (mm)		
1–3	− 0.30 (− 0.07 to − 0.62)	− 0.39 (− 0.23 to − 0.64)
4–6	− 0.21 (0.01 to − 0.57)	− 0.38 (− 0.12 to − 0.72)
⩾7	− 0.25 (− 0.03 to − 0.47)	− 0.23 (− 0.06 to − 0.53)

ScRP, scaling/root planing; MWF, modified Widman flap; − denotes loss of attachment.

periodontal treatment and thorough SPC of mean (SD) duration of 11.3 (4.9) years. Seventy-three patients received SPC from their private dentist and 98 received SPC in a University-based clinic. With respect to the delivery of care, 32% of patients seen by the private dentists and 5% of patients seen at the University clinic received 0–1 SPC appointments each year whereas 68% of those seen by private dentists and 95% of those seen at the University clinic received two to four SPC appointments each year ($p < 0.0001$). For the population as a whole, 7.3% (303 of the original 4138) of teeth were lost during active therapy compared with 7.7% of teeth that were lost during SPC. A more detailed analysis was based on the prevalence of pockets ⩾5 mm/patient. At the end of the treatment phase, 29% of patients had 0 pockets ⩾5 mm and this reduced to 19% after SPC. The respective, patient-based data for the prevalence of 1–4, 5–8 and ⩾9 mm pockets were 40%, 41%; 16%, 18%; and 15% and 23%. The predominant shifts, therefore, are a significant reduction in the proportion of patients with no 5 mm pockets and a significant increase in the proportion of patients with ⩾9, 5 mm pockets after SPC. Of the 39 patients with ⩾9, 5 mm pockets, 22 (30%) had received SPC from a private dentist whereas 17 (17%) had continued to receive the more intensive care in the University clinic. The data also confirmed that any deep (⩾7 mm) pocket or bleeding site/tooth was an identifiable risk for tooth loss during the period of SPC.

Finally, Bogren et al. (2008a) reported 3-year follow-up data in a cohort of 65 participants with a history of chronic periodontitis and who were recruited to the positive control arm of a RCT. The period of recall was 6 months and the SPC programme included subgingival mechanical debridement of sites ⩾5 mm which continued to bleed on probing, tooth polishing and reinforcement of oral hygiene measures. The article was excluded from the systematic review because the patients had been in SPC for up to 12 months before the baseline measurements were recorded. Nevertheless, the study is worthy of mention due to the duration of follow-up and the high quality of reporting: inclusion and exclusion criteria; calibration, training and blinding of examiners, randomization and allocation concealment; stratification of subjects according to smoking habits; reporting of mean ΔCAL; and accounting for loss of subjects and, or sites. The principal outcome of interest was that over 3 years, the mean (SE) ΔCAL in the cohort was 0.7 (1.04) with 95% CI [0.46–0.98]. For comparative purposes to other studies of shorter duration, the mean gain of attachment at 1 and 2 years was 0.6 mm.

The observations and data from these articles have not been used in formulating the conclusions and recommendations of the systematic review and economic evaluation.

Cost effectiveness evaluation of SPC

The values and sources of the data used in the economic evaluation are presented in detail in Appendix B. The discounted costs and benefits within selected years and a 30-year total of SPC are given in Table 3. These data show that over 30 years the difference in costs between SPC provided by a specialist practice and a general dentist in private practice is €4466 and between specialist practice and a general dentist in a health service (State) practice is €5938. The difference between specialist and either generalist option in terms of discounted tooth loss is an extra 20.59 tooth years lost for generalist SPC, and an extra 3.95 mm discounted clinical attachment loss. Therefore using private generalist SPC as a baseline, the ICERs for SPC delivered in specialist care are €217 for one extra tooth year or an extra €1130 for 1 mm less attachment loss. Using health service (State) generalist SPC as the baseline the ICERs are an extra €288 for one extra tooth year or an extra €1503 per 1 mm loss of attachment for specialist SPC.

Sensitivity analysis

Clearly, there is uncertainty about the values we have used in this analysis. We can probe the influence of this uncertainty by varying parameters in a sensitivity analysis. Treatment costs are highly dependent on the duration of treatment. While we assumed 20 min. for hygienist appointments in general practice and 30 min. in specialist practice, it is instructive to examine the effects of varying these basic assumptions.

State provision in general practice is costed on a fee-per-item basis, hence patient costs would be unaffected by the time of appointment. Keeping specialist appointments at 30 min. and reducing generalist times to 10 min. increases ICERs to €272 per tooth year lost and €1415/mm CAL. Likewise increasing generalist times to 30 min. reduces ICERs to €176 per tooth year lost and €921/mm CAL. Conversely, if specialists adopt 60-min. hygienist appointments, but we maintain the 20-min. private generalist hygienist appointment, then the ICERs increase to €515 per tooth year lost or €2683/mm CAL.

While evidence suggests that loss of attachment can be arrested with appropriate specialist care (see Table 1), the rate of attachment loss in general practice will likely be influenced by the quality of treatment. The generalist data from the paper we used is likely to represent good practice, and as such ensures a conservative estimate of the cost-effectivenesss of specialist treatment.

Discussion

Systematic review

The articles included in the review were published over a 26-year period between 1975 and 2001 and demonstrated considerable variation in methodological quality and in heterogeneity with respect to the duration of SPC, recall intervals, the elements of care provided, numbers of patients (participants), and the initial treatment phase. For the purpose of the

Table 3. Discounted costs and benefits in selected years and after 30 years

Year	Specialist		Generalist			
	discounted cost (€)	discounted tooth years lost	discounted state cost (€)	discounted private cost (€)	discounted tooth years lost	discounted attachment loss (mm)
1	407.12	0.033	95.14	172.48	0.117	0.433
3	380.10	0.093	88.82	161.01	0.327	0.405
6	342.72	0.168	80.11	145.22	0.590	0.140
10	298.76	0.244	69.80	126.56	0.856	0.122
20	211.82	0.346	49.49	89.71	1.214	0.087
30	150.08	0.368	35.08	63.60	1.291	0.061
30 year totals	7749	8.210	1811.12	3283.28	28.807	3.946*

*The undiscounted loss over 30 years is 5.800 mm. See the discussion on why it is not clear that attachment loss should be discounted.
The formula used to calculate the discount in any given year (t) where the discount rate is r is $1/(1+r)^{t-1}$. [Note the $(t-1)$ term implies that costs occurring during the year are counted at the beginning of the year.] So, with the discount rate of 3.5%, in year 10 the discounted cost incurred in that year would be €407.12 × $1/(1+0.035)^9$ = €298.76.

review, it was decided *a priori* to include studies in which the patients received either or both non-surgical and surgical treatments although the review was restricted to patients with chronic rather than aggressive periodontitis with a view to observing the effect of a period of care on patients with a single disease entity.

The review included on only two studies that evaluated the impact of SPC delivered in both specialist and general dental practices or environments with respective periods of follow-up for 6 and 3 years (Axelsson & Lindhe 1981, Cortellini et al. 1994). In addition, there were two studies which did not involve general dental practitioners but did incorporate different programmes of SPC that might be considered to be consistent with provisions within specialist and general care: professional tooth cleaning every 2 weeks *versus* scale and polish every 6 months (Nyman et al. 1975); coronal scaling *versus* subgingival scaling (Jenkins et al. 2000). All the remaining studies evaluated the magnitude of clinical attachment change during SPC delivered in hospital, university and specialist programmes.

The data from the review clearly show that when a programme of intensive SPC is provided frequently and in a specialist environment then long-term periodontal stability is achievable with expected attachment change of −0.01 to 0.2 mm over periods of 1–6 years (Nyman et al. 1975, Axelsson & Lindhe 1981, Cortellini et al. 1994). The comparative cumulative change of attachment in patients managed by SPC in a general dental environment is −1.8 to −2.8 mm over the same periods (Nyman et al. 1975, Axelsson & Lindhe 1981, Cortellini et al. 1994). The mean attachment level changes are of similar magnitude irrespective of whether the data are presented as full mouth means (Nyman et al. 1975, Axelsson & Lindhe 1981) or from target sites, in this instance following guided tissue regenerative surgery (Cortellini et al. 1994). Further, it is apparent that the mean loss of attachment at target sites or target teeth following GTR following 4 years of SPC is significantly greater when the SPC involves only scaling and root instrumentation at those sites that continue to bleed following gentle probing (Table 1) (Weigel et al. 1995).

With frequent, specialist SPC, the stability of chronic periodontitis is upheld over longer periods of up to 12 years with cumulative attachment loss of −0.26 to −0.87 mm when reporting full mouth (Rosling et al. 2001b) or non-molar tooth (Rosling et al. 2001a, Serino et al. 2001) mean data. Similar, long-term data for patients who continue to be seen in general dental practice do not appear to be available.

A further observation with respect to the consistency of data are the reported attachment changes during SPC following treatment with scaling and root planing followed by modified Widman flap surgery: −0.23 mm at interproximal sites after 5 years (Ramfjord et al. 1975); −0.25 mm at moderately deep sites after 4 years (Pihlstrom et al. 1981); −0.25 mm at non-molar sites after 12 years (Serino et al. 2001). However, there is some variation on these data with reports of −0.72 mm of attachment loss over 5 years SPC (Becker et al. 2001) and −0.12 mm over 2 years (Kaldahl et al. 1988) at initially moderately deep sites. This consistency is further consolidated when the means and ranges of attachment loss are determined across different initial pocket depths, following either scaling and root planing alone or in combination with modified Widman procedures and SPC (Table 2).

Narrative review

There were two articles in which SPC was delivered in specialist/university clinics and by the referring general dentist but unfortunately, the authors did not distinguish between the cohorts in the results (Moser et al. 2002, Heden & Wennström 2006). Preshaw & Heasman (2005), however, did undertake a study in which patients were either referred to their general dentist or maintained in a hospital clinic for the delivery of SPC. Although clinical attachment was not reported, this is the only study to indicate that, albeit over a short period of I year, SPC provided in general dental services is equally efficacious as that provided in a hospital clinic. This finding is in contrast to that of Matuliene et al. (2008) who reported a significantly higher prevalence of pockets ⩾5 mm in those patients receiving SPC from their general dentists compared with those receiving SPC in a university clinic over a mean duration of 10 years. This is perhaps consistent with the observations made in a retrospective study of tooth loss over the same period of 10 years in which patients with irregular SPC had an increased risk ratio of 3.17 for tooth loss over patients who received regular SPC in a university-based periodontal clinic (Eickholtz et al. 2008).

The data of Bogren and colleagues were also considered to be worthy of mention in narrative review in which a mean gain of attachment of 0.7 mm was

seen in a cohort receiving SPC over 3 years (Bogren et al. 2008a, b). In comparison with the studies in the systematic review, this represents the gain of attachment of greatest magnitude with, over the same time period of 3 years, both Nyman et al. (1975) and Axelsson & Lindhe (1981) reporting a gain of approximately 0.1 mm in their cohorts of patients. Such a difference may be attributed to specific selection and reporting of proximal sites of pocket depths $\geqslant$5 mm (Bogren et al. 2008a, b) as opposed to the reporting of full mouth mean scores in comparative studies (Nyman et al. 1975, Axelsson & Lindhe 1981).

Cost-effectiveness evaluation

The cost evaluation analysis was undertaken using the data from the one study that was most closely aligned to answering the focused question of the systematic review (Axelsson & Lindhe 1981). From these data, which were based on full mouth mean data, it is clear that SPC provided in specialist environment is more effective than SPC delivered by the general practitioner when the outcomes are judged as clinical attachment or tooth loss. This increase in effectiveness, however, comes at a greater cost to the patient. The economic methodology allowed us to look at the efficiency which combines both the cost and effectiveness (i.e., a cost-effectiveness analysis) and this showed that, for the patient, the difference between SPC in specialist and generalist private practice is an extra €210 per extra tooth year over 30 years. The question still remains as to whether specialist SPC is worthwhile, and it is likely this will vary for different patients, with some being willing to pay this amount and others not.

From the health economics viewpoint, consideration should also be given as to whether benefits should be discounted. In this model, although it is clear that tooth years lost should be discounted (as a tooth year now is likely to be preferred to a tooth year later) discounting of clinical attachment loss is less intuitive. In fact, if we take the example of going from 2 to 3 mm attachment loss and compare it to going from 5 to 6 mm attachment loss, it may be assumed that the later change may be preferred less. Given that both costs and tooth years lost are discounted, however, it is appropriate to discount all outcomes.

These data must be interpreted with some caution. In particular, the cost-effectiveness analysis is only as good and valid as the data upon which it is based. In this instance, the outcome data are from only one study that reported full mouth mean clinical outcomes over 6 years. Relatively few details were provided regarding the SPC programmes for those patients referred to general care; written information was provided with an emphasis placed on providing the patients with a ''detailed plaque control programme''. There was no assessment of compliance. These, therefore, were considered to be the best data available although a more exact and perhaps meaningful future analysis could be based on prospective attachment change data from specific target sites and over an extensive period of SPC. For the longer-term evaluation these data, therefore, were extrapolated over 30 years, and this was undertaken on a simple linear scale. Clinical attachment loss and disease progression (with ultimate tooth loss) will not likely progress on a linear scale for any one individual, tooth or tooth site (Gilthorpe et al. 2003) so the tooth loss in the evaluation is likely to be a conservative estimate. Additionally, we recognize that costs of periodontal treatment and SPC to the patient, the State (health services) and to the practitioners and dental hygienists will vary considerably from country to country, and so only a basic costing exercise was undertaken. Again, for simplicity, the evaluation was based upon the fee-per-item of service system used in Scotland (UK) (which was preferred to the less transparent, banded system of patient charges now used in England), the fee scale from one specialist practice together with authors' estimates of time of procedures, and of travelling.

Further, any model requires certain assumptions to prevent it becoming unwieldy. In this case, the assumptions about what generalist SPC entailed were necessary as this was not detailed in the paper (Axelsson & Lindhe 1981) nor any other article in the review but it may have a large influence on costs. Also, the assumptions that tooth loss was the only cost-incurring event apart from the actual SPC programme and that no further retreatment was carried out are unrealistic. Given the large cost difference, however, relaxing either of these assumptions would be unlikely to change the direction of the evaluation; that is, SPC provided by the specialist would remain more expensive. Such treatments or retreatments, which have been omitted from the economic evaluation to maintain simplicity of the model, would be indicated on an irregular basis and may include root instrumentation, periodontal surgery with or without regenerative techniques and adjunctive, locally delivered antimicrobials.

Although the concept of tooth years lost is more accurate than teeth lost, this does not take account of the difference in utility of teeth in different states of different areas of the mouth. Using a quality adjusted measure such as Quality Adjusted Tooth Years (Birch 1986) would be more accurate, but there are no data on what would affect the quality or what the weights would be. Additionally, the study on which our cost-effectiveness evaluation was undertaken (Axelsson & Lindhe 1981) does not report data on individual teeth, so even if the weightings were available, they could not be applied in this analysis. In fact, the approach should be from a whole mouth perspective and so an oral health-related quality-of-life measure would be more appropriate than a tooth-based utility measure.

Finally, for the permanent dentition, tooth loss is not a naturally occurring event and will inevitably be influenced by factors outside the remit, timescale and application of an economic model. For, example, the attitude of general dental practitioners towards periodontally involved teeth may vary considerably both at any one time point and certainly over an extended period of 30 years.

Conclusions

Supportive periodontal care delivered in specialist compared with general dental practice will likely result in greater periodontal stability and higher tooth survival rates.

An economic evaluation of cost-effectiveness based on model remuneration scales, care provision in the United Kingdom and assumptions made specifically for this model indicate that the clinical benefit from the provision of SPC in specialist practice is more expensive with incremental cost effectiveness ratios of approximately €290 for one extra tooth year and €1500 for 1 mm less clinical attachment loss over 30 years.

Recommendations for research

- Evaluate this cost-effectiveness model in different communities and oral health systems.
- A prospective, long-term RCT should compare patient-related and clinical outcomes in patients who are randomized to receive SPC in either specialist or general dental practice. Details of SPC provision, periods of recall and compliance should be reported. Such a trial should include an evaluation of:
  - costs and cost-effectiveness, thus eliminating some of the assumptions that have been made in this review;
  - patients' views with respect to the costs of SPC and future treatment, and their ''willingness to pay''.

Implication for clinical practice

- Patients should be informed of the need for SPC and their own responsibilities for future care. This should include an overview of the possible long-term clinical outcomes and the costs of achieving those outcomes and of maintaining a functional dentition.

Acknowledgements

We would like to express our sincere gratitude to Dr. Jørgen Slots (Editor-in-Chief of *Journal of Periodontal Research*, Professor Maurizio Tonetti (Editor-in-Chief of *Journal of Clinical Periodontology* and Dr. Kenneth Kornman (Editor-in-Chief *Journal of Periodontology*) for their immediate responses to requests for information regarding papers in press in their respective Journals. We are also indebted to Professor N. P. Lang, Dr. R. P. Teles and Dr. P. Eickholz for sending unpublished data and texts for consideration for inclusion in the Review and to Professor J. Lindhe for his immediate response to a request for information. Finally, we wish to thank Mrs. Gwen Forster for her invaluable assistance in the preparation of the manuscript.

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Clinical Relevance

Scientific rationale for the study: Supportive periodontal care (SPC) is an essential requirement after periodontal treatment and may be delivered in either specialist or general dental practice.

Principal findings: SPC in specialist as compared with general practice will result in greater periodontal stability when evaluated using clinical attachment as the primary outcome. It will, however, be more expensive.

Practical implications: Patients may retain the option of receiving SPC from their general dentist rather than a specialist and there may be practical reasons for doing so. They must, however, be fully informed regarding likely clinical outcomes and the full economic costs incurred with both options.

Appendix A

Table A1. Search strategies and histories for MEDLINE and EMBASE

Subject headings/text words/indexing terms	Results
Search filter for identifying titles in MEDLINE	
1. EXP Periodontics/	16867
2. EXP Periodontal Diseases/	51344
3. Periodontitis/OR periodontal abscess/OR periodontal pocket/	13787
4. Maintenance.mp	144222
5. Supportive therapy.mp	1867
6. 1 OR 2 OR 3	57770
7. 1 AND 2 AND 3	3780
8. 6 AND 4	1282
9. 7 AND 4	275
10. 7 AND 5	17
11. 4 OR 5	146032
12. 7 AND 11 (Yield)*	283
Search filter for identifying titles in EMBASE	
1. Maintenance.mp	92362
2. EXP maintenance therapy/	249865
3. Supportive therapy.mp	1380
4. EXP PERIODONTITIS/pc,di,dm,rh,su,th	1675
5. EXP Periodontal Disease/pc,di,dm,rh,su,th	3398
6. 1 OR 2 OR 3	331701
7. 4 OR 5	3398
8. 6 AND 7	302
9. Limit 8 to human	293
10. From 9 keep 1-292	292
11. From 9 keep 1-292 (Yield)*	292

*Total yield after removal of duplicates.

Appendix B

Table B1. Values and sources of data used in the economic evaluation

Data		Source
Patient charge for 30 min. with hygienist in specialist practice	€71.09	1
Patient charge for 20 min. with hygienist in generalist health service (State) practice	€13.66	2
Patient charge for 20 min. with hygienist in generalist private practice	€52.33	1
Patient charge for extraction	€15.51	2
Patient charge for extraction and resin retained bridge	€180.10	2
Patient charge for extraction and removable prosthesis	€88.98	2
Patient charge for extraction and implant	€2800	1
Average hourly earning (based on UK data)	€18.72	3
Hours lost for 30 min. with hygienist in specialist practice	1.5	4
Hours lost for 20 min. with hygienist in generalist practice	0.83	4
Hours lost for extraction	0.83	4
Hours lost for extraction and resin retained bridge	3.17	4
Hours lost for extraction and removable prosthesis	4.17	4
Hours lost for extraction and implant	7.5	4
Percentage choosing extraction	15%	4
Percentage choosing extraction and resin retained bridge	40%	4
Percentage choosing extraction and removable prosthesis	40%	4
Percentage choosing extraction and implant	5%	4
Annual tooth loss rate for SPC in specialist practice (mm)	0.033	5
Annual tooth loss rate for SPC in generalist practice (mm)	0.117	5
Annual rate of attachment loss for patients in specialist practice (mm)	0.000	5
Annual attachment loss rate for patients receiving SPC in generalist practice during the first three years (mm)	0.433	5
Annual attachment loss rate for patients receiving SPC in generalist practice during years 4 onwards (mm)	0.167	5

Sources: 1. Paterson (2008) Personal communication; 2. National Health Service, Scotland (2007); 3. Office of National Statistics (2007); 4. Authors' estimated data; 5. Axelsson & Lindhe (1981).