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Re-treatment profiles during long-term maintenance therapy in a periodontal practice in Norway

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Abstract

Background: Periodontal therapy coupled with active maintenance has been shown to be effective in maintaining periodontal health, however, the question of re-treatment is rarely alluded to in the literature.

Aim: To quantify the type and extent of re-treatment in a group of patients who had completed a definitive course of periodontal treatment in a Norwegian specialist periodontal practice. The study also investigated factors associated with the provision of periodontal surgery as a re-treatment modality.

Methods: A consecutive group of patients who had comprehensive periodontal treatment, which included periodontal surgery, and were subsequently maintained for between 10 and 17 years were studied.

Results: One hundred and one patients with an average age at reassessment of 59.4 (standard deviation (SD) 9.0) years were studied. The average length of the review period was 13.1 (SD 1.9) years. In addition to routine maintenance, 50 patients had further re-treatment and 40 of those who were re-treated had periodontal surgery in the study period. Logistic regression showed that independent predictors of surgical re-treatment, with the effects adjusted for other variables in the model, were uncertain or poor prognosis at baseline, erratic or poor post baseline compliance and a family history of periodontal disease.

Conclusion: Considerable amounts of re-treatment, including in many cases extensive non-surgical treatment or periodontal surgery, were provided for patients who had surgical periodontal treatment and were subsequently maintained for least 10 years in a specialist periodontal practice.

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Studies based in specialist practices have shown that with effective periodontal therapy the majority of patients with periodontitis will have very low levels of tooth loss over long periods of time (Hirschfeld & Wasserman 1978, McGuire 1991, Fardal et al. 2004). It has been suggested that an active and frequent maintenance programme is a necessary part of such periodontal therapy (Lindhe & Nyman 1984, Kocher et al. 2000). However, because of a lack of relevant studies it is difficult to establish how active this maintenance programme should be. The question of re-treatment is rarely alluded to in the literature and usually only features in the context of exiting patients from clinical trials because of deteriorating periodontal conditions. It is not clear why the re-treatment of periodontal disease has not been a focus of clinical research. Wilson & Kornman (1996) suggested that this was because of the complexity of the subject, limited knowledge of the disease process, inac-

curacy in measuring disease progression and a reluctance to discuss apparent failures with colleagues.

Most academic institutions and specialist practices have well defined criteria for the re-treatment of periodontal maintenance patients, which are principally based on clinical findings. However, there is no doubt that this is a contentious area. It has been shown that predicting outcome from initial prognosis based on presently available criteria is not accurate particularly for multi-rooted teeth (McGuire 1991). Furthermore, it has recently been shown that periodontists trained in the USA and Europe do not agree on the perceived risk of the deterioration of periodontal conditions (Persson et al. 2003).

It would be useful to report on the retreatment of maintenance patients from clinical settings which have a proven high level of long-term tooth retention. Fardal et al. (2003, 2004) have shown that it is possible to obtain good long-term compliance with maintenance therapy and high levels of tooth retention in periodontal patients. The current study was based in the specialist practice in Norway which formed the basis for these studies (Fardal et al. 2003, 2004). The aim was to quantify the type and extent of re-treatment in a group of patients who had completed a definitive course of periodontal treatment, which included periodontal surgery and were subsequently placed on a maintenance programme. The study also investigated factors associated with the provision of periodontal surgery as a re-treatment modality.

Materials and Methods

A consecutive group of patients reviewed in a specialist periodontal practice in Norway between January and mid-April 2003, who had been treated for periodontal disease by the principal investigator (O. F.) 10 or more years previously, formed the study population. The specialist practice was located in two neighbouring locations at Egersund and Flekkefjord. An inclusion criterion was that all the patients had undergone periodontal surgery as part of their definitive treatment. The patients were mainly Northern Europeans and drawn from small rural Norwegian communities. A description of the specialist practice set-up and the assessment of the different variables have previously been described (Fardal et al. 2004). The following were noted for each patient: the dates of their initial examination, the completion of definitive treatment and final review, age at review, gender, smoking status, medical history, family history of periodontal disease and compliance with prescribed maintenance (poor, erratic or good).

After the completion of definitive treatment at baseline all patients were seen between one and three times per year in the specialist practice for maintenance care. The maintenance visits with the specialist practitioner alternated with visits to the general dental practitioner such that all patients were seen in total between two and four times per year. During each maintenance visit, scaling and polishing of teeth was routinely performed according to the needs of each patient. Oral hygiene instruction and reinforcement were given as appropriate. Minor occlusal adjustments were performed as necessary. The interval between recall visits was shortened or lengthened as appropriate according to the stability of the periodontal condition.

Oral hygiene was assessed by the clinician at each of the maintenance visits based on the distribution and abundance of plaque. The oral hygiene status at each visit was determined as follows: Good equated to little or no generalized plaque. Moderate equated to the generalized presence of minor amounts of plaque (not covering more than 1/3 of the buccal/lingual surfaces from the gingival margin) or isolated areas of abundant plaque (covering more than 1/3 of the buccal/lingual surfaces from the gingival margin). Poor equated to generalized abundant plaque (covering more than 1/3 of the buccal/ lingual tooth surfaces from the gingival margin). The overall oral hygiene status represented the predominant score over the study period. For example, if good oral hygiene was recorded on five occasions and moderate oral hygiene on 15 occasions, the overall oral hygiene status as classified as moderate.

All tooth loss between the initial examination and the final review was quantified with no attempt to identify tooth loss which occurred as a specific result of periodontal disease. The prognosis (poor, uncertain, moderate, good), which had been assigned to each patient at the initial examination, was identified from the case records.

Re-treatment was defined as treatment over and above prescribed maintenance and included the prescription of systemic antibiotics, non-surgical treatment or surgical treatment. Re-treatment was judged necessary in two clinical situations. One was when deep pockets ($\geq 7 \text{ mm}$) were identified which exhibited bleeding on probing. The other was when increases in pocket depth (\geq 3 mm) were identified which was accompanied by persistent bleeding on probing at three successive maintenance visits. The time, which had elapsed between the completion of baseline definitive periodontal therapy and each re-treatment, was recorded. The type of teeth, which were re-treated was recorded as was the actual location of the practice in which the re-treatments were completed.

There were 105 patients who met the inclusion criteria, however, four of those had presented with increasing pocket depths and persistent bleeding at an early stage of the review period. They all had persistently poor oral hygiene and were not motivated for more therapy above the prescribed maintenance. They had refused re-treatment as they were unwilling to comply with the maintenance programme prescribed by the principal investigator. They were therefore excluded from the study population and their data were not analysed further.

Statistical analysis

Chi-square analysis was used with the level of significance set at p < 0.05. Unadjusted odds ratios and confidence intervals were calculated using standard methods. Multivariate analysis was carried out using logistic regression to identify possible predictors of periodontal surgery during the period of review and to calculate odds ratios adjusted for possible confounders.

Results

One hundred and one (57 female, 44 male) patients with an average age at re-assessment of 59.4 (standard deviation (SD) 9.0, range 37–80) years were studied. The average length of the review period was 13.1 (SD 1.9, range 10–17) years. Only 74 (2.9%) of the 2541 teeth present after the initial baseline treatment were lost during the review period, which equated to 0.06 teeth per patient per year.

Re-treatment

In addition to routine maintenance 50 out of the 101 patients had further retreatment during the observation period. Six patients were treated with systemic antibiotics and four others were treated with non-surgical therapy in addition to the prescribed maintenance. The remaining 40 of those who were retreated received periodontal surgery. Surgery was preceded by non-surgical periodontal therapy in 11 of these cases.

Periodontal surgery

In total 306 (12%) of the teeth present after baseline had surgical treatment

during the study (Table 1). This was broken down into 95 incisors and canines (31%), 90 pre-molars (29%) and 121 molars (40%). In the 40 patients who had surgery on average 7.7 (SD 6.9, range 1-28) teeth were involved. The majority 34 of those who had surgery had all their surgical procedures during one course of treatment. They had had on average 2.4 (SD 1.6, range 1-6) surgical procedures and the interval between baseline and the provision of surgery was on average 10.1 (SD 3.7, range 3-16) years. The remaining 6 patients required further surgery at a subsequent course of treatment and they had on average 4.0 (SD 1.9, range 2-7) surgical procedures. The average time to first surgery was 6.7(SD 3.7, range 3-13) years with the second course of treatment with surgical intervention after 11.2 (SD 2.1, range 9-15) years.

The surgical techniques were tailored to each individual re-treatment area. The surgical techniques used were gingivectomies, modified Widman flaps, full flaps with- or without apical positioning. A combination of these techniques was sometimes used in one surgical area. Data on the different surgical techniques were therefore not obtained.

At baseline 18 (35%) of those who had no re-treatment were adjudged to have had a good prognosis compared with only five (13%) of those who subsequently had surgery as a re-treatment (Table 2). During the observation period virtually all the no re-treatment group (92%) had good compliance compared with 73% of those who had surgery (Table 2). The assessed levels of oral hygiene over the period of the study were very similar between the no-re-treatment and the surgery group (Table 2).

Various factors which could have affected the likelihood of surgery as a re-treatment were investigated. Subjects were dichotomized in relation to compliance into a group which had "erratic or poor" compliance with the remainder of the subjects forming a group which had "good" compliance. In relation to prognosis subjects were dichotomized into those with an "uncertain or poor" and those with a " moderate or good" prognosis. The dichotomization of other factors is as shown in Table 3. Surgery during re-treatment was more likely to have been provided for patients who had been classified with an uncertain or poor prognosis, who had less than ideal compliance after definitive treatment and those who attended Egersund, one of

the two practices involved in the study (Table 3). A family history of periodontal disease was the strongest factor associated with surgery (p < 0.0001) with an unadjusted odds ratio of 7.32 (95% confidence interval 2.78–19.28).

To correct for confounding effects all the independent variables included in Table 3 were entered in a logistic regression analysis with the dependent variable being whether a subject had periodontal surgery during the period of study. The result of the multivariate analysis is shown in Table 4. Uncertain/ poor prognosis (p = 0.0006), erratic/ poor compliance (p = 0.008) and a positive family history of periodontal disease (p = 0.004) were significantly associated with the provision of surgery as a re-treatment modality in the final statistical model. It can be seen from Table 4 that, after correction for the

Table 1. Re-treatment by tooth type

Jpper		15	22	14	10	9	8	8	12	9	12	14	15	16	15	
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Lower	2	8	16	11	9	10	5	5	4	5	8	6	11	15	11	1

Numbers of each tooth type surgically re-treated during the 10-17 year observation period.

Table 2. Prognosis assessed at baseline with compliance and oral hygiene during the 10-17 year observation period by type of re-treatment

	No re-treatment $(n = 51)$	Antibiotics $(n = 6)$	Non-surgical $(n = 4)$	Surgical $(n = 40)$
Prognosis				
Good	18	0	1	5
Moderate	18	1	0	6
Uncertain	10	2	3	24
Poor	5	3	0	5
Compliance				
Good	47	6	4	29
Erratic	4	0	0	6
Poor	0	0	0	5
Oral hygiene				
Good	14	0	0	10
Moderate	31	3	4	23
Poor	6	3	0	7

Table 3. Characteristics of the study population by whether periodontal surgery was required for re-treatment

	Surgery $(n = 40)$	No Surgical treatment $(n = 61)$	χ^2	р	Odds ratio	Confidence interval
Sex						
Male	17	27				
Female	23	34	0.03	0.86	0.93	0.42 - 2.08
Smoking						
Smoker	18	33				
Non smoker	22	28	0.80	0.37	0.69	0.31-1.55
Prognosis						
Uncertain/poor	29	23				
Good/moderate	11	38	11.71	0.0006	4.35	1.83-10.35
Compliance						
Erratic/poor	11	4				
Good	29	57	8.37	0.004	5.40	1.58-18.46
Family history						
Yes	21	8				
No	19	53	18.38	< 0.0001	7.32	2.78-19.28
Tooth loss						
Lost teeth	10	26				
No tooth loss	30	35	3.27	0.07	0.44	0.19 - 1.08
Location						
Egersund	29	25				
Flekkefjord	11	36	9.64	0.002	3.79	1.60-8.98

Table 4. Predictors of periodontal surgery: results of logistic regression analysis

	Coefficient	SE	χ^2	р	Odds ratio	Confidence interval
Sex (Male/female)	- 0.36	0.54	0.43	0.51	0.70	0.24-2.03
Smoking(Smoker/non smoker)	-0.57	0.56	1.05	0.31	0.57	0.19-1.68
Prognosis (Uncertain or poor/moderate or good)	2.15	0.63	11.75	0.0006	8.61	2.51-29.51
Compliance (erratic or poor/good)	2.06	0.77	7.13	0.008	7.82	1.73-35.43
Family history (Yes/no)	1.75	0.60	8.49	0.004	5.75	1.77-18.64
Tooth loss (lost teeth/no tooth loss)	-0.82	0.61	1.82	0.18	0.44	0.14-1.45
Practice location (Egersund/Flekk)	1.02	0.55	3.39	0.07	2.77	0.94-8.19

other independent variables in the multivariate analysis, the association between practice location and surgery was no longer significant (p = 0.07). The association between a family history of periodontal disease and surgery also weakened after incorporation into multivariate analysis. Gender, smoking status and tooth loss during the study period were not significantly associated with the provision of surgery as a re-treatment (Table 4).

Discussion

This study was designed to investigate the re-treatment profiles of maintenance patients attending a specialist periodontal practice in Norway. The main finding was that patients who had completed a definitive course of surgical periodontal treatment required considerable amounts of further re-treatment, including in many cases extensive nonsurgical treatment or periodontal surgery, during long-term maintenance.

The results indicated a high level of re-treatment with a substantial need for some re-treatment modality, over and above normal maintenance, in almost half of the patients studied. However, there is a lack of comparable data as this is one of the first studies to document the level of re-treatment in compliant patients who were well maintained over a significant time period in specialist practice. Indeed the question of re-treatment is rarely alluded to in the literature except that a number of recognized leading clinicians have published their personal opinions and recommendations (Chace 1996, Kerry 1996, Nevins 1996, Ochsenbein 1996, Wilson & Kornman 1996). If, when and how to re-treat those who respond poorly to periodontal treatment is not well documented. Most academic institutions and specialist practices use flow charts to identify poor responders (Wilson & Kornman 1996). However, the frequencies, definitions and descriptions of the contents of supportive periodontal treatment visits including re-treatment have not been universally defined. The data which can be abstracted from classical university-based studies, which compared nonsurgical with surgical treatment, also indicate fairly high levels of re-treatment. The proportion of participants in such studies who were re-treated varied from 24% in a 4-year period (Pihlstrom et al. 1981) to 29% in a 5-year period (Ramfjord et al. 1987).

The present findings should also be interpreted in the light of the differences which exist between various clinical settings. Studies on tooth loss have shown substantial differences during maintenance in relation to the clinical setting, ranging from a single periodontist working in a specialist practice (Hirschfeld & Wasserman 1978, McFall 1982, Wilson et al. 1984, Goldman et al. 1986. McGuire 1991) to multiple operators working in university clinics (Wood et al. 1989, Tonetti et al. 2000, Konig et al. 2002). In addition, a significant variation in the rate of compliance with maintenance therapy has been reported from 16% (Wilson et al. 1984) to 87% in the present clinical setting (Fardal et al. 2003). The study of re-treatment is further complicated because in practices with low compliance patients may be rereferred after a variable interval for periodontal problems. Depending on the time which has elapsed since the initial course of treatment, these patients may be classified as new patients not maintenance patients requiring re-treatment. This is pertinent as the present study found that the average time from completion of definitive periodontal therapy to re-treatment was almost seven years. Alternatively, after an interval some patients could be referred to different periodontists and therefore not be recorded as re-treatment cases.

Decisions on re-treatment of periodontal disease are based on risk assess-

ment using up to date clinical tools. There is, however, evidence that risk assessments based on subjective expert dentist and periodontist opinion vary too much to be useful in periodontal decision making (Persson et al. 2003). Recently, Page et al. (2003) described a risk assessment model aimed at producing more uniform and accurate periodontal decision making. The risk model incorporated factors such as age, smoking history, diabetes, history of surgery, pocket depth, furcation involvement, subgingival calculus or restorations. bone height and the presence of vertical bone lesions. This model, however, is only based on untreated periodontal disease and it remains to be seen if it can be adapted to treated and maintained periodontal patients.

In the current study re-treatment was judged necessary in two clinical situations. One was when deep pockets $(\geq 7 \text{ mm})$ were identified which exhibited bleeding on probing. This was because deep pockets were difficult to manage, because of concerns regarding access, during routine maintenance visits. The other situation was when increases in pocket depth ($\geq 3 \text{ mm}$) were identified accompanied by persistent bleeding on probing. An increase in pocket depth of $\geq 3 \text{ mm}$ has previously been used as a criterion for recurrent periodontitis (Mombelli et al. 1989, Kaldahl et al. 1996).

In the present study, a significant proportion of the patients had periodontal surgery as part of their re-treatment. The major criterion used to make the decision to perform surgery was the clinical judgement of the operator that non-surgical therapy would not provide sufficient access to the worsening lesion(s). It is accepted that other clinicians may not have adopted a surgical approach in so many cases. Nevertheless, we would argue that the factors which predicted the provision of surgery as a re-treatment modality could be viewed as risk indicators for disease progression during periodontal maintenance. Independent predictors of surgical re-treatment in the present study, with the effects adjusted for other variables in the model, were uncertain or poor prognosis at baseline, erratic or poor post baseline compliance and a family history of periodontal disease. The identification of a family history as a risk factor supports the finding that the genetic make up contributes to the susceptibility to periodontitis (Michalowicz 1994). However, there is nothing which can be done to change the genetic make up of those treated for periodontitis. The relationship between poor or erratic compliance and the need for re-treatment is not surprising. Efforts to improve compliance may be beneficial in reducing the need for re-treatment. The relationship with initial prognosis suggests that early diagnosis, when disease is not so advanced could also reduce the need for repeated surgical treatment.

Other studies have highlighted the importance of oral hygiene as a critical determinant of the success of periodontal treatment (Lindhe & Nyman 1984). It was difficult to classify the oral hygiene status over the whole study period because of fluctuations in plaque control in the subjects. As a result oral hygiene was not entered into the multivariate analysis but compliance acted as a surrogate. It was not possible to measure several other factors which could have affected disease progression and the need for re-treatment such as fluctuations in stress levels, inter-current illnesses and medications. It is difficult to incorporate all the variables which could affect the need for re-treatment in a study of this type. In the current study smoking did not emerge from the multivariate analysis as a significant factor predicting surgical re-treatment. This may have been because smoking had been taken into account when the initial decisions regarding definitive treatment were made. Some smokers who had poor oral hygiene having been excluded from receiving periodontal surgery and therefore not being eligible for recruitment for this study. It is possible that tooth extraction could be considered as a form of re-treatment leading to the elimination of periodontal disease. However, in the current study the focus was on treatment aimed at retaining teeth despite the effects of periodontal disease.

Randomized controlled trials should ideally be used to test the need for and value of re-treatment of maintenance patients, however, for ethical reasons these studies are difficult to carry out. A less valuable alternative is the present retrospective study of re-treatment profiles, which only collected data for those patients who actually had attended over the study period. The situation may be worse as some patients were undoubtedly lost to follow-up. The value of the current study is enhanced by the previous reports of a high level of compliance and low long term tooth loss in the practice environment in which the study was completed (Fardal et al. 2003, 2004). The risk factors for re-treatment were different from those previously reported for continued tooth loss in the same practice environment during maintenance therapy, which were male gender, older age (>60 years) and smoking (Fardal et al. 2004). Furthermore, it is interesting to observe that the surgically re-treated patients had a similar long term tooth loss to the cases that it was not considered necessary to re-treat. It could be argued that this indicated the effectiveness of the re-treatment methods used.

In conclusion, this study found that nearly half of the patients who were initially treated for periodontal disease and regularly maintained required retreatment at least once over a 13-year period. Thorough maintenance care, including where necessary surgical retreatments, seemed to control further tooth loss for patients at risk because of uncertain or poor initial prognosis, erratic or poor compliance and a family history of periodontal disease.

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Clinical Relevance

Scientific rational for study: An active maintenance programme is a necessary part of periodontal therapy. However, little is known about how active this maintenance programme should be.

The aim of this study was to assessre-treatment in a Norwegian spe-

cialist practice, which has previously reported high compliance rates and low tooth loss.

Principal findings: One hundred and thirteen patients were studied over 13 years and it was found that 50 of these patients required re-treatments, mostly surgery.

Practical implications: The high recurrence rate of periodontal disease reported in this study represents diagnostic and manpower challenges. However, more studies are required to establish if these results are representative of other specialist practices.

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