

Tooth loss in well-maintained patients with chronic periodontitis during long-term supportive therapy in Brazil

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Abstract

Aim: The objective of this retrospective study was to assess the reasons for tooth loss in a sample of patients who underwent periodontal therapy and supportive periodontal therapy (SPT) in a Brazilian private periodontal practice.

Material and Methods: A sample of 120 subjects who had been treated and maintained for 10 years or longer was selected from patients attending a periodontal practice. All patients followed a similar treatment: basic procedures, re-evaluation and periodontal surgery where indicated. Reasons for tooth loss were categorized as periodontal, caries, endodontal, root fractures and extraction of retained or partially erupted third molars.

Results: Of the 2927 teeth present at the completion of active periodontal treatment, 53 (1.8%) were lost due to periodontal disease, 16 (0.5%) for root fracture, six (0.2%) to caries, five (0.2%) for endodontic reasons and 31 (1.0%) were lost to extraction of retained or partially erupted third molars. Logistic regression analysis was performed to investigate the association between five independent variables with tooth loss due to periodontitis. Only age (>60 years) and smoking were statistically significant (p < 0.05).

Conclusion: The findings of this survey were consistent with previous studies. Older subjects and smokers were more susceptible to periodontal tooth loss. In addition, patients with generalized chronic periodontitis were treated and maintained for long-term periods with low rates of tooth loss.

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The retention of natural teeth can improve the quality of life by maintaining the ability to chew and digest food (Drisko 2001). The clinical response of an individual tooth to treatment over time is difficult to predict accurately, especially if the tooth has been compromised by periodontal disease and the patient did not return periodically to maintenance care appointments (Becker et al. 1984, DeVore et al. 1986, McLeod et al. 1998). Supportive periodontal therapy (SPT) is defined as the periodic assessment and preventive treatment of the periodontal apparatus, in order to allow early detection and treatment of new or recurring disease (AAP 1992). The main objectives of SPT are: (1) to prevent or minimize the recurrence and progression of periodontal disease in patients who have been previously treated for gingival diseases, periodontal diseases or peri-implantitis; (2) to prevent or reduce the incidence of tooth loss by monitoring the dentition and any prosthetic replacement of the natural teeth; and (3) to increase the probability of locating and treating other diseases or conditions found within the oral cavity (AAP 1998). Usually, SPT includes an update of the medical and dental histories, extra-oral and intra-oral soft tissue examination, dental examination, periodontal evaluation, radiographic review, removal of dental plaque and calculus from supragingival and subgingival sites, selective root planing if indicated, tooth polishing and a review of the patient's plaque removal efficacy (AAP 1998).

The effectiveness of periodontal treatment and long-term SPT in preventing tooth loss in patients with periodontitis has been reported in several surveys. Studies conducted in North America (Oliver 1969, Ross et al. 1971, Hirschfeld & Wasserman 1978, McFall 1982. Goldman et al. 1986. Wilson et al. 1987. Nabers et al. 1988. Wood et al. 1989, McLeod et al. 1998, Matthews et al. 2001), Europe (Lindhe & Nyman 1984, Tonetti et al. 1998, Checchi et al. 2002, König et al. 2002, Axelsson et al. 2004, Fardal et al. 2004, Dannewitz et al. 2006) and Oceania (Pearlman 1993) were unanimous in demonstrating that the treatment of periodontal disease, followed by a maintenance care programme, can maintain periodontal health and reduce tooth loss in most patients over long-term periods.

Historically, the first studies were conducted by Oliver (1969) and Ross et al. (1971). However, the retrospective study conducted by Hirschfeld & Wasserman (1978) is considered a benchmark study of tooth loss due to periodontal reasons. These authors reexamined 600 patients in a private periodontal practice after their active periodontal treatment and SPT. Patients were grouped according to the number of teeth lost during SPT: (1) well-maintained group (WMG), lost 0-3 teeth; (2) downhill group (DG), lost 4-9 teeth; and (3) extreme downhill group (EDG), lost 10-23 teeth. They found that only 1110 (7.1%) of the 15,666 teeth present after initial treatment were lost due to periodontal reasons, over a 22-year average period of maintenance.

In spite of the number of retrospective surveys published in different parts of the world, in English-language journals there have been no clinical studies focusing on the effect of long-term SPT among South American well-maintained patients in terms of further tooth loss. The objective of this retrospective study was to assess the prevalence and reasons for tooth loss in a sample of patients who underwent periodontal therapy and long-term SPT in a Brazilian private practice.

Materials and Methods

Study population and inclusion criteria

A sample of 120 high-medium social class subjects (47 males and 73 females) who had been treated and maintained by scaling, root planing and tooth polishing was selected from patients attending a private periodontal practice in São Paulo, Brazil. These subjects were selected

from an initial sample of 1057 attended patients. The inclusion criteria included the following: (1) age ≥ 20 years; (2) a maintenance regime at a 6- to 12-month interval with an experienced periodontist (L. A. C.); (3) at least 10 years of continued SPT; and (4) a diagnosis of generalized chronic periodontitis. Patients with a history of refractory periodontitis or repeated abscess formation, a known systemic disease (e.g. diabetes mellitus, AIDS or other established medical risk factors for periodontal disease), poor hygiene levels during the period of SPT (e.g. fullmouth plaque score >40%, Lang et al. 1997), who ceased smoking during the period of SPT or with dental implants were not included in the study.

The average age of patients at the time of initial therapy was 38.9 years (20–72 years). One-hundred and eight patients (90%) were below 51 years of age and 81 (67.5%) were between the ages of 31 and 50 (Table 1). Also, the distribution of subjects by years of regular SPT can be seen in Table 2.

Clinical and radiographic measurements

At the initial examination, full-mouth periapical radiographs were taken and full medical and dental history was obtained. Data included probing depth (measured at six sites around teeth), tooth mobility, furcation involvement, plaque and gingival indexes (Löe 1967). Radiographic measurements provided

Table 1. Distribution of subjects according to age

Age (years)	Initial examination n (%)	Final examination <i>n</i> (%)
20-30 31-40 41-50 51-60 61 > 20	27 (22.5%) 41 (34.2%) 40 (33.3%) 8 (6.7%) 4 (3.3%)	$\begin{array}{c} 0 \ (0\%) \\ 11 \ (9.2\%) \\ 29 \ (24.2\%) \\ 38 \ (31.6\%) \\ 42 \ (35.0\%) \end{array}$
Total	120 (100.0%)	120 (100.0%)

Table 2. Distribution of subjects by years of SPT

	Years of SPT						
	10–19	20 or more	Total				
Male Female Total	32 (26.7%) 48 (40.0%) 80 (66.7%)	15 (12.5%) 25 (20.8%) 40 (33.3%)	47 (39.2%) 73 (60.8%) 120 (100%)				

SPT, supportive periodonttal therapy.

information about the level of the alveolar bone (e.g. extension of the periodontal destruction caused by peridontitis and furcation involvements).

Periodontal diagnosis

The initial periodontal diagnosis of these patients was based on the current classification system at the time of patient admission. The records of all patients who underwent periodontal therapy and long-term SPT at this periodontal practice were reviewed and reclassified according to 1999 AAP classification system (AAP 1999). Only patients diagnosed as having generalized chronic periodontitis were entered in this study.

Individual tooth diagnosis

Based on the severity of the periodontal conditions at the time of the original examination, each tooth was assigned an individual tooth diagnosis founded upon the criteria suggested by AAP (1999):

Gingivitis: Bleeding on probing without clinical attachment loss or radiographic loss of periodontal structures.

Slight periodontitis: Clinical attachment loss of 1–2 mm with bleeding on probing.

Moderate periodontitis: Clinical attachment loss of 3–4 mm, bleeding on probing and where furcation involvement was present this did not exceed degree I. Mobility degree I may be present.

Severe periodontitis: Clinical attachment loss > 5 mm, bleeding on probing and where furcation involvement was present it was degree II or III. Mobility degree II or III may be present.

Periodontal treatment and SPT

All patients followed a similar treatment protocol: (1) oral hygiene instructions; (2) scaling and root planing; (3) tooth polishing; (4) re-evaluation; and (5) periodontal surgery where indicated. Supportive periodontal care appointments included an update of the medical and dental histories, dental examination, review of the patient's plaque removal efficacy, periodontal probing, removal of dental plaque and calculus from supragingival and subgingival sites, selective root planing where indicated, tooth polishing and application of topical fluorides. During SPT, individual

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periapical radiographs were taken as needed.

Table 3. Distribution of tooth loss by tooth type and reasons for extraction, excluding extraction of retained and partially erupted third molars

		Periodontal	Caries	Endodontal	Fractures
	Molars	29	2	2	1
lost	Pre-molars	8	2	1	9
accord	Canines	6			3
scoseu	Incisors	10	2	2	3

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53

Table 4. Distribution of subjects according to the number of teeth lost during SPT (all reasons)

6

	0 to 3 teeth	4 to 9 teeth	Total	
Male	42 (35.0%)	5 (4.2%)	47 (39.2%)	
Female	68 (56.6%)	5 (4.2%)	73 (60.8%)	
Total	110 (91.6%)	10 (8.4%)	120 (100%)	

SPT, supportive periodonttal therapy.

Total

was 2927 (mean 24.3 ± 5.7). During SPT, 111 teeth (3.8%) were lost and of these, 53 (1.8% of all teeth present at baseline) were lost due to periodontal disease, 16 teeth (0.5%) were lost due to root fracture, six teeth (0.2%) were lost to caries, five teeth (0.2%) were lost for endodontic reasons and 31 teeth (1.0%)were lost to extraction of retained or partially erupted third molars (Table 3). The majority of teeth lost were molars (65). From these molars, 29 were lost due to periodontal reasons and 36 due to the other factors (31 were retained or partially erupted third molars). Maxillary central incisors and second premolars were the teeth least frequently lost. Mandibular pre-molars were the teeth most frequently lost to root fractures (6).

The average rate of tooth loss per patient was 0.44 for periodontitis, 0.13 for root fractures, 0.05 for caries, 0.04 for endodontic reasons and 0.25 for extraction of third molars, accounting for an overall rate of 0.92 teeth lost per patient. Of the 53 teeth lost due to periodontal reasons, six (11.4%) initially had a diagnosis of slight periodontitis, 36 (67.9%) had a diagnosis of moderate periodontitis and 11 (20.7%) had a diagnosis of severe periodontitis.

According to the number of teeth lost during the maintenance phase, 77 patients (64.2%) lost no teeth, 18 patients (15.0%) lost one tooth, nine patients (7.5%) lost two teeth, six patients (5.0%) lost three teeth, five patients (4.2%) lost four teeth, two patients (1.7%) lost five teeth and three patients (2.5%) lost nine teeth (Table 4). In this study, 8.4% of patients (e.g. patients who experienced tooth loss of four, five or nine teeth) accounted for Table 5. Distribution of tooth loss due to periodontal reasons by years of SPT

16

Total

34

20

9

17

80

	Years of SPT						
	10 to 19	20 or more	Total				
Male Female Total	12 (22.6 %) 9 (17.0%) 21 (39.6%)	23 (43.4%) 9 (17.0%) 32 (60.4%)	35 (66.0%) 18 (34.0%) 53 (100%)				

SPT, supportive periodonttal therapy.

51.3% of all teeth lost (57). Furthermore, 59.2% of all tooth loss (63) occurred after 20 years of SPT. Tooth loss due to periodontitis followed a similar distribution (60.3%; Table 5).

Smokers (65.0%), older subjects (35.7%), males (25.5%), patients who followed periodic SPT for at least 20 years (25.0%) and patients who returned once a year for maintenance recall visits (20.6%) had experienced the highest percentages of tooth loss due periodontal reasons (Table 6). However, the degree of association between the dependent variable and the suspected predictors' factors was investigated by statistical analysis in an attempt to avoid confounding effects. The results of the logistic regression analysis are shown in Table 6. The independent variables age (p = 0.005) and smoking (p = 0.011)were found to be correlated with the number of teeth lost due to periodontal reasons, with odds ratio of 7.14 (95% confidence interval (CI): 1.78-28.63) and 4.76 (95% CI: 1.42-15.89), respectively. Conversely, no significant differences were found between the dependent variable and the other predictor factors, i.e. gender (p = 0.16), number of annual recall visits (p =0.60) and period of SPT (p = 0.88).

Tooth loss during SPT

The number and type of teeth including third molars, were ass from records data recorded at the most recent examination of each patient. During SPT, the decision to extract a tooth was based on their clinical and radiographic conditions. Reasons for tooth loss were categorized as periodontal (e.g. advanced furcation involvement, increasing mobility, advanced bone loss, extension and severity of periodontal destruction with the dentition and individual tooth response to SPT) caries (non-restorable conditions), endodontal (untreatable endodontic pathology), root fractures (when clinical crown-lengthening procedures were contra-indicated due to impossibility of obtaining an adequate crown-to-rootratio) or oral surgical extraction of retained or partially erupted third molars. Teeth lost as part of the initial therapy were not counted as being lost during the period of SPT.

Statistical analysis

The analyses were performed using the NCSS[®] 2000 software package (Number Cruncher Statistical System, NCSS, Kaysville, UT, USA). Descriptive statistics were used to synthesize collected data. Logistic regression analysis was performed to investigate the association between age, gender, period of SPT, number of annual maintenance care appointments and smoking habits with tooth loss due periodontitis. The dependent variable was the presence of tooth loss, i.e. subjects who had lost at least one tooth due to periodontal reasons, in order to assess factors that might identify individuals who were more likely to experience periodontal tooth loss. Also, an odds ratio with a 95% confidence limit were calculated. Differences at p < 0.05 were considered statistically significant.

Results

The average duration of SPT was 17.4 vears, with a range of 10–36 years. The mean recall frequency of the 120 patients was 9.4 months. The total number of teeth present in the 120 patients after initial active periodontal therapy

Table 6.	Logistic	regression	analysis:	Predictors	of tooth	loss di	ue to	periodontal	reasons
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	Ν	Teeth lost	Patients with at least one tooth loss	RC	SE	χ^2	р	OR	95% CI	LRS
Age (years)										
< 60	78	12	6 (7.7%)	1.96	0.70	7.72	0.005	7.14	(1.78 - 28.63)	0.063
> 60	42	41	15 (35.7%)							
Gender										
Male	47	35	12 (25.5%)	-0.77	0.56	1.91	0.16	0.45	(0.15 - 1.38)	0.016
Female	73	18	9 (12.3%)							
Annual recall vis	its									
Once	68	43	14 (20.6%)	-0.30	0.58	0.27	0.60	0.73	(0.23 - 2.31)	0.002
Twice	54	10	7 (12.9%)						· /	
Period of SPT										
< 20 years	80	21	11 (13.7%)	-0.10	0.69	0.02	0.88	0.90	(0.22 - 3.57)	0.000
> 20 years	40	32	10 (25.0%)						· · · · ·	
Smoking habits			× ,							
Non-smokers	100	29	8 (8.0%)	1.56	0.61	6.44	0.011	4.76	(1.42 - 15.89)	0.053
Smokers	20	24	13 (65.0%)						. ,	

RC, regression coefficient; SE, standard error; χ^2 , Chi-Square; p, p-value; OR, odds ratio; CI, confidence interval; LRS, least R^2 .

Discussion

In this study, during the maintenance period, 53 teeth (1.8%) from the total number of teeth present at the completion of active periodontal treatment (2927) were lost due to periodontal reasons. The majority of patients (64.1%) lost no teeth. Thus, only a minority of treated patients (8.4%) was responsible for more than a half of tooth extractions (51.3%) during SPT (Table 4). This is in line with the data from McLeod et al. (1998), Tonetti et al. (2000), König et al. (2002), Checchi et al. (2002) and Fardal et al. (2004).

Similar to Fardal et al. (2004), this retrospective survey was mainly focused on tooth extraction due to periodontal reasons, in an attempt to identify possible risk factors. The influence of patientbased independent variables (e.g. age, gender, number of annual recall visits, period of SPT and smoking status) was estimated with logistic regression analysis (Table 6). Only age (>60 years) and smoking were statistically significant (p < 0.05). These results agree with those of König et al. (2002) and Dannewitz et al. (2006) (e.g. smoking) and Fardal et al. (2004) (e.g., age and smoking). However, other local, systemic or environmental factors (e.g. race-ethnicity/socioeconomic status, oral hygiene level, diabetes mellitus or other established risk factors) can contribute to the amount of tooth loss in other(s) specific groups of patients (Heitz-Mayfield 2005).

With respect to tobacco smoking, most of the current evidence identifying it as a risk factor for the progression of periodontal disease relates to cigarette smoking (Tonetti & Claffey 2005). Usually, patients who smoke 10 or more cigarettes per day are strongly associated with periodontitis (Norderyd & Hugoson 1998). Tonetti et al. (1998) reported that during the period of SPT, smokers might present a significant increase in the prevalence of bleeding pockets when compared with previous smokers and non-smokers. Airila-Månsson et al. (2005) concluded that smokers had more severe marginal bone loss over time when compared with neversmokers. In our study, due to the small number (20) and percentage of smokers (16.7%), the number of cigarettes smoked per day was not included in this survey. Patients were only grouped as non-smokers or smokers.

With respect to tooth type, molar teeth were more susceptible to loss due to periodontitis than non-molar teeth, especially the maxillary first and second molars. These findings were similar to those presented by other studies (Hirschfeld & Wasserman 1978, Goldman et al. 1986, Wood et al. 1989, McLeod et al. 1998, Konig et al. 2002, Fardal et al. 2004, Airila-Månsson et al. 2005). Conversely, maxillary central incisors and mandibular second premolars were the teeth least frequently lost. In the study conducted by Wood et al. (1989), canines were the teeth least frequently lost.

Traditionally, following the initial active periodontal therapy, all patients are instructed to continue receiving periodic SPT. It has been shown that regular compliance with maintenance care appointments is associated with very low levels of tooth loss (Fardal et al. 2004). In contrast, patients having poor compliance are 5.6 times more likely to lose teeth, than regularly compliant patients (Checchi et al. 2002). Nevertheless, Novaes et al. (1999) reported that only 36.7% of all treated patients remain compliant after 10 years. Ojima et al. (2005), in their study on the relationship between attitudes and desires at initial office visit and compliance with SPT, concluded that desire for good oral health may not be related consistently to continuation of SPT.

Similar to other retrospective studies, this survey may have some inherent limitations, such as the lack of a parallel control group or blinded examinations. However, the selection of an appropriate control group, especially in a private periodontal practice, is the major concern. It could be seen that the majority of patients without a periodontal diagnosis did not return periodically for maintenance care appointments with the periodontist. In such cases, multicentre studies can be required to achieve statistical power (Renvert & Persson 2004). Also, individual variations in the susceptibility to periodontitis progression, even in a group of patients presenting the same periodontal diagnoses, may represent a limitation in comparing individual tooth loss.

In addition, the type of periodontitis that the patient has may be more important in predicting further tooth loss than the type of periodontal defect (McLeod et al. 1998). This study included only patients diagnosed as having generalized chronic periodontitis. Chronic periodontitis is a multifactorial disorder where microbial dental plaque biofilms are considered the essential aetiological agent for the initiation of the inflammatory process (Albandar 2002). In contrast to other forms of periodontal disease, the amount of periodontal loss is consistent with the presence of local factors (e.g. bacterial plaque) and the rate of progression is slow to moderate, but periods of rapid progression can occur (AAP 1999). In three previous publications (Heitz-Mayfield et al. 2003, Schätzle et al. 2003a, b), the clinical course of chronic periodontitis was evaluated over a 26-year period. It was observed that sites that always bled on probing during regular recall check-ups had a higher risk for attachment loss when compared with always healthy sites (Schältzle et al. 2003a). Besides, even in well-maintained subjects who practiced oral hygiene and returned periodically for maintenance care appointments, the incidence of periodontal destruction increased with age, especially between 50 and 60 years of age (Heitz-Mayfield et al. 2003). However, this progression of periodontal destruction seemed to be slight to moderate, varying between 0.02 and 0.1 mm/year (Schältzle et al. 2003b).

In summary, within the limits of this study, this descriptive retrospective analysis of a selected group of patients treated at a private periodontal practice provided new information on the reasons for tooth loss among well-maintained subjects attended in a South American country (Brazil). These findings are consistent with other studies. conducted in other countries, which have evaluated tooth loss among patients treated for periodontal disease and subsequently maintained for longterm periods. Older subjects (>60 years) and smokers were more susceptible to periodontal tooth extractions. In addition, patients with generalized chronic periodontitis were treated and maintained for long-term periods with low rates of tooth loss.

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Clinical Relevance

Scientific rationale for study: In English-language journals, there have been no clinical studies focusing on the effect of periodontal treatment and long-term periodontal therapy

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in preventing tooth loss in wellmaintained patients attending in South America.

Principal findings: The majority of patients lost no teeth during supportive therapy. Also, two risk fac-

tenance care. *Journal of Periodontology* **60**, 516–520.

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tors were statistically associated with the amount of tooth loss due periodontal disease, i.e. smoking and age.

Practical implications: Well-maintained patients can present low rates of tooth loss due to periodontal reasons. This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.