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Abstract

Aim: The aim of the study was to determine the survival rates of questionable and hopeless teeth in patients with aggressive (AgP) and chronic periodontitis (CP) during 15 years of supportive periodontal therapy (SPT).

Methods: 34 AgP and 34 CP patients (SPT≥10 years) with bone loss of ≥50% at ≥2 teeth were consecutively recruited. Bone loss was measured on digitized radiographs and teeth were categorized as "questionable" (≥50 to <70% bone loss) or as "hopeless" (≥70%). Progression in probing depths (PPD) during SPT, tooth loss and reasons for extraction were analyzed.

Results: In AgP patients 262 teeth were considered as questionable and 63 as hopeless (CP: 149/51). During active therapy (APT), 25 questionable and 26 hopeless teeth were extracted (CP: 12/16). During 15.3±4.1 years of SPT of AgP 28 questionable and 15 hopeless teeth were removed (CP: 28/12). Mean tooth loss per patient during SPT in total was 0.14 (AgP) and 0.16 (CP) teeth/year. There were no significant differences in tooth loss or longitudinal progression of PPD between AgP and CP patients.

Conclusions: In patients with aggressive periodontitis 88.2% (209 of 237) of questionable and 59.5% (22 of 37) of hopeless teeth survived 15 years during regular SPT in a dental school department.

Clinical Relevance

Scientific rationale for the study: The success of long-term retention of teeth is well documented in previous studies. When regular supportive periodontal treatment was performed tooth loss was rarely observed. In this study the survival rate of questionable and hopeless teeth in patients with aggressive versus chronic periodontitis during long-term supportive therapy lasting more than 15 years was evaluated.

Principle findings: In AgP and CP, a higher proportion of questionable than hopeless teeth survived at the end of the supportive periodontal therapy; approximately 80-88% of questionable teeth survived, compared to only 60-66% of teeth classified as hopeless.

Practical implications: Periodontal treatment is meaningful for patients susceptible to periodontitis irrespective of the prognosis. The aim of treatment should be to prevent the progression of periodontal disease and to prevent early extraction and inevitable prosthetic rehabilitation.

Introduction

Periodontal therapy is a successful means of arresting periodontal disease progression and maintaining patients' teeth. Its aim is long-term retention of the natural dentition in a healthy, functional, aesthetically acceptable and painless state (Schweizerische Zahnärzte-Gesellschaft 2000, Greenwell 2001). Retention of teeth over the complete life span is an attainable goal. Schätzle et al. (2009) and Lang et al. (2009) in this context demonstrated the importance of an inflammation free environment. Teeth with sites consistently presenting a gingival index of 0 (no inflammation) had a 50-year survival rate of 99.5% compared to 63.4% for sites with a gingival index of 3 (severe inflammation).

Aggressive periodontitis (AgP) is sub-classified into a localized (LAgP) and a generalized (GAgP) type. It predominantly affects younger subjects and is characterized by an early destruction of the clinical attachment with subsequent severe alveolar bone loss (Armitage 1999). Few studies have evaluated the treatment modalities for AgP (Xajigeorgiou et al. 2006, Mestnik et al. 2010, Bäumer et al. 2011). The current notion is that a prerequisite for periodontal healing is the reduction and/or elimination of microbial pathogens and that there may be a benefit from the use of adjunctive antibiotics (Herrera et al. 2002, Haffajee et al. 2003).

Successful treatment of periodontitis is greatly influenced by risk factors at tooth level as well as by environmental and genetic risk factors at patient level (Greenwell et al. 2001). Smoking is among the several environmental risk factors influencing tooth loss during long-term periodontal maintenance (McGuire & Nunn 1996a, König et al. 2002a, Chambrone & Chambrone 2006, Pretzl et al. 2008, Matuliene et al. 2008) and diabetes mellitus (Faggion et al. 2007). Genetic risk factors, however play a more important role in aggressive than in chronic periodontitis (Loos et al. 2005).

Essential prerequisites for long-term retention of teeth being treated for periodontitis are a good compliance of each patient and an individualized SPT (Knowles et al. 1979, Axelsson & Lindhe 1981a,b, Pihlström et al. 1983, Kaldahl et al. 1996, Rosling et al. 2001). Moreover, it has been demonstrated that with regular SPT tooth loss becomes rather rare (Hirschfeld & Wasserman 1978, McFall 1982, McGuire et al. 1996b, König et al. 2002a, Fardal et al. 2004, Chambrone & Chambrone 2006, Faggion et al. 2007, Pretzl et al. 2008, Matuliene et al. 2008).

In clinical practice the decision to treat or extract teeth is based not only on clinical presentation and patient's risk factors but also on treatment philosophies, financial aspects and insurance regulations. McGuire 1991 and McGuire & Nunn 1996a, b evaluated the accuracy of a widely accepted prognosis model based on the traditional notion that the prognosis of a tooth presenting >50% bone loss becomes *questionable* and eventually *hopeless* and found it rather ineffective. Other long-term studies further reported that retention of such teeth with a predicted *questionable* or *hopeless* prognosis over five to ten years was feasible (McGuire et al. 1996a,b, Machtei & Hirsch 2007, Eickholz et al. 2008, Pretzl et al. 2008). Little is known about the treatment results and the long-term retention perspectives of periodontally compromised teeth in moderate to advanced aggressive periodontitis.

The aim of the study was (1) to determine the survival rate of teeth presenting with initial bone loss of ≥50 % in patients with aggressive periodontitis as compared to patients with chronic periodontitis, (2) to evaluate the changes in pocket probing depths during supportive therapy lasting up to 16 years and to compare the follow up of probing depths in patients with aggressive and chronic periodontitis and (3) to identify reasons for tooth extractions in such patients.

Material and Methods

Study population

This investigation was designed as a longitudinal retrospective study based on demographic and clinical data. The methodological quality was consistent with the standard of the Newcastle-Ottawa scale (Wells et al. 2001). Patients with aggressive periodontitis (AgP) were identified according to the 1999 classification (Armitage 1999). In the present study, patients were classified as AgP if they were ≤35 years of age at the first proof of disease onset and had been characterized by radiographic bone loss of ≥50%. Patients older than 35 years presenting earlier radiographs with signs of severe periodontal destruction were also allocated to the AgP group. CP patients in the control group presenting bone loss of ≥50% had to be ≥40 years of age at the first proof of disease onset.

Between 1982 and 1998 a total of 2564 patients were treated for moderate to advanced chronic (CP) or aggressive (AgP) periodontitis in the Department of Periodontology, Christian-Albrechts-University of Kiel, Germany. 34 patients diagnosed for AgP, receiving SPT for ≥10 years with ≥1 visit/year, presenting bone loss of ≥50% at ≥2 teeth and with an annual PPD documentation as well as a complete x-ray documentation at baseline (T0), at the end of the active periodontal therapy (T1) and at the last documented visit of supportive periodontal therapy (T2) qualified for participation in the study (Fig. 1). Employing the same criteria, 34 out of 239 consecutive CP patients were matched.

Active and supportive periodontal therapy

Active periodontal therapy (APT) was non-surgical, mechanical root debridement with, when indicated, additional access flap surgery. Furcation debridement was performed with diamond-coated sonic scaler inserts (Kocher & Plagmann 1999). In some patients, guided tissue regeneration, endodontic treatment, tunneling procedures, molar root resections and/or prosthetic rehabilitations were carried out. No pocket elimination surgery, osseous resection or augmentation of intrabony defects was undertaken. Patients presenting a persistent inflammation received adjunctive metronidazole/amoxicillin antibiotics (van Winkelhoff et al. 1996). In the case of an underlying endodontic cause an endodontic treatment was initiated. After six months a reevaluation was completed.

SPT followed an individualized interval of three to twelve months:

(1) Staining of plaque followed by re-instruction and re-motivation.
(2) The utilization of interdental brushes was demonstrated and practiced by the patient at every appointment with particular focus on the selection of the right brush diameter.
(3) Professional tooth cleaning and mechanical subgingival debridement of residual pockets, followed by polishing using rubber cups and polishing paste with exhaustive application of a fluoride gel was performed by the dental auxiliary.
(4) Once a year, the dental status was recorded by the operator and pocket probing depths (PPD) were measured at six sites per tooth.
(5) If necessary, further treatment was defined and consisted of either non-surgical subgingival debridement alone or open flap debridement with or without subsequent systemic or local antibiotic therapy. Retaining the vitality of molars with furcation involvement was of utmost importance. Tunneling or even molar root resection was performed only if non-cleanable furcations (grade II / III) showed persistent inflammation.

Pocket probing depths and radiographic assessment

PPD measured once a year at six sites of each tooth were entered into a database (K. G.). Data for third molars were included. The accuracy of the data input of about 127704 PPD values (63546/64158 AP/CP) was verified by reading randomly selected samples of 20 data sets (J.F.W.) with a consistency of 99.1% (266 errors in 29698 PPD). Plots for PPD were constructed to compare the progression of PPD between AgP and CP patients.

For radiographic evaluation at T0 (baseline) and T2 (last visit of SPT), 136 radiographs of 68 patients were digitized and analyzed by the first examiner (J.F.W.) using an image processing program (ImageJ, NIH, Maryland, USA). The cemento-enamel junction (CEJ), the most apical extension of the alveolar crest and the root apex at each tooth (only deepest site) were marked. If a restoration was present, its most apical point next to the CEJ was marked. All linear distances were expressed as percentages of total root length. JFW was calibrated before the beginning of the radiographic evaluation. The measurements were determined by an experienced operator (C.G.) and the interexaminer reproducibility was verified by a second measurement (J.W.F). We verified the reproducibility by assessment of pivotal landmarks. Multi-walled intraosseous pockets, which were difficult to analyze on the radiographs because of overlying bony walls, were compared to clinical measurements. According, in part, to McGuire & Nunn (1996b) and Machtei & Hirsch (2007), teeth were categorized “questionable” if they had lost from ≥50 to <70% of bone height at one proximal surface or ”hopeless” if they had lost ≥70%.

Tooth loss during APT and SPT

Teeth lost during the initial phase of the APT (T0-T1) and during the SPT (T1-T2) were documented. The reason for tooth loss was evaluated and classified as either periodontal or other reasons (endodontic involvement, caries, restorative purposes, fracture or unknown reasons). To distinguish the reasons for extraction notations on charts, clinical and radiological findings were analyzed and, if possible, the treating dentist was interviewed. The following rationale was used to determine between periodontal and other reasons for extractions: A periodontal cause was assumed if there was a continuous increase of the probing depths and progressive, radiographically apparent bone loss.

Data managing and statistical analysis

Data were sampled in a database (ParoDat, Department of Periodontology, Kiel, Germany), which was installed in 1982 and was set up on a database platform (FileMaker Inc., Santa Clara, USA) for continuous documentation of all patients. For the present study, the following data were evaluated: age, gender, smoking status, periodontal diagnosis, observation time, modified full mouth plaque scores, and the follow up of PPD during APT and SPT. Tooth loss was used as the primary outcome measure and the true endpoint.

All patients gave their informed consent for the statistical analysis of their data documented during periodontal therapy. The Ethical Committee of the Christian-Albrechts-University of Kiel approved the protocol of the study. After pseudonymisation, all data were exported into a separate data set for statistical analysis. Comparisons between AgP and CP patients were performed for tooth loss, probing depths and plaque index using a paired *t*-test. Statistical significance was declared for *p*-values of <0.05. All statistical analysis was conducted using SPSS (SPSS16, SPSS Inc., Chicago, USA).

Results

Patient data

The total observational period for AgP patients was 16.1±4.5 (10-24) years and for CP 16.3±4.1 (10-24) years respectively; the mean duration of the SPT was 15.3±4.1 years for AgP and 15.7±3.6 for CP. Further demographic data are shown in Table 1. In AgP patients 76.5% were non-smokers (CP: 88.2%). All patients received a similar periodontal treatment. Adjunctive antibiotic therapy was initiated in 10 (29.4%) cases of aggressive periodontitis (APT: 6/during SPT: 4), but in no cases of CP. In AgP molar root resection was performed in 1 case (CP: 5). Five of the patients received guided tissue regeneration (AgP: 2/CP: 3).

The numbers of predicted questionable and hopeless teeth are shown in Table 1. At the beginning of APT, patients with aggressive periodontitis demonstrated more questionable (n=262) and hopeless (n=63) teeth compared to patients with chronic periodontitis (149/51) ($p<0.05$).

Tooth loss and reason for extraction

The numbers of teeth at baseline (T0) and at the end of SPT (T2) are shown in Table 2 and 3. During APT (T0-T1), 70 teeth respectively 7.6% (AgP) and 40 teeth respectively 4.6% (CP) of all teeth present (AgP: 923, CP: 874) were extracted. During SPT (T1-T2) in AgP patients, 72 teeth (8.4%) of all the remaining teeth (AgP: 853) were extracted (CP: 93 of 834 teeth/ 11.2%).

Of the remaining teeth in AgP, 11.8% (28 of 237) questionable (CP: 20.4%/ 28 of 137) and 40.5% (15 of 37) hopeless teeth (CP: 34.3%/ 12 of 35) were extracted during SPT (T1-T2).

A total of 20.2% (53 of 262) questionable teeth (CP: 26.8% /40 of 149) and 65.1% (41 of 63) hopeless teeth (CP: 54.9% /28 of 51) were extracted during APT and SPT (T0-T2). In AgP patients, 78.9% (112 of 142 of all extracted teeth) were lost for periodontal reasons during APT and SPT (CP: 36.1%, 48 of 133). In AgP the number of questionable teeth extracted for periodontal reasons during APT and SPT was 81.1% (43 of 53) (CP 65.0% /26 of 40) and 41.5% (17 of 41) for the hopeless teeth (CP: 57.1% /16 of 28).

The survival rates of teeth, which were extracted during SPT, are shown in Table 3. The most commonly extracted teeth during APT and SPT were the third and first molars. During active treatment and supportive therapy (T0-T2), 20.6% (7 of 34) of the AgP patients lost no teeth (CP 14.7%/ 5 of 34) and 29.4% (10 of 34) lost more than 6 teeth (CP 20.6%/ 7 of 34) (Table 3.) None of the patients lost all of their teeth. There were no statistically significant differences in tooth loss between AgP and CP groups, neither for *questionable* and *hopeless* teeth nor for different tooth types or reasons for extractions.

Clinical course of PPD during SPT

At the beginning of SPT (T1) in AgP, the mean PPD was 3.9±1.3 mm (CP: 3.6±1.0 mm) and at the end of SPT (T2) 3.6±1.2 mm (CP: 3.5±1.2 mm) as shown in Table 1. In AgP 67% of the teeth (CP: 64%) presented a PPD <4mm, 31% of teeth 4-6mm (CP: 34%) and 2% > 6mm (CP: 3%). The charts for PPD illustrate the follow-up of the mean PPD during the observation time (T0-T2) for questionable (Fig. 2) and hopeless teeth (Fig. 3) in AgP and CP patients. There were no significant differences. Mean values beyond 15 years of SPT were not representative due to smaller numbers of patients.

Discussion

Patient selection

The aim of the study was to evaluate the survival of teeth presenting an initial bone loss of ≥50 % in patients treated for aggressive periodontitis compared to patients with chronic periodontitis. Tooth loss is the primary outcome measure and a true endpoint. Therefore, we determined the rate of tooth loss during a long-term SPT of 15 years.

To avoid bias, 68 compliant patients with a SPT of ≥10 years were consecutively selected from a cohort with moderate to advanced periodontitis treated between 1982 and 1998. The patients assigned to the AgP group were ≤35 years of age at the first proof of disease onset and had been characterized by radiographic bone loss of ≥50%. To reduce an overlap with the AgP group, CP patients had to be ≥40 years of age. Even though age dependant categories to distinguish between aggressive periodontitis and chronic periodontitis were eliminated in the 1999 classification, Armitage & Cullinan (2010) considered it justified to use age-related discrimination for research purposes. At the beginning of the therapy, the amount of bone loss had to be the same in patients with aggressive and chronic periodontitis. Subsequently CP patients were consequently matched in pairs.

To comply with the inclusion criterion of ten years observation time, the number of patients was initially reduced from 2564 to only 456 patients. This was due to patients drop out quitting therapy in our department as many patients continued their treatment and maintenance in private practice. We have no results on the survival rate of questionable or hopeless teeth in patients who continued the treatment in a private practice. We assume that, according to the guidelines in the German health system, the vast majority of teeth presenting bone loss ≥50% were removed.

Treatment of periodontitis

In our study, all patients received treatment based on a protocol, which has remained consistent since 1982. Patients were treated primarily by conservative means in order to retain as many critical teeth as possible. APT was performed by subgingival scaling and root planing and/or open flap debridement and in some patients, guided tissue regeneration, tunneling procedures and/or molar root resections were carried out. The operators and the assistant dental professionals were well trained on root debridement by means of hand or mechanically driven instruments using special learning programs (Rühling et al. 2002, König et al. 2002b). In patients presenting severe AgP only 17.6% received antibiotics during APT and 11.8% during SPT. No patients with severe CP received antibiotic therapy. As of yet, there are no established protocols for efficiently controlling aggressive periodontitis, but the current notion is that systemic metronidazole and amoxicillin can improve the short-term clinical outcome of non-surgical debridement in AgP (Guerrero et al. 2005, Mestnik et al. 2010). The current study shows, that long-term retention of questionable and hopeless teeth in cases with severe aggressive or chronic periodontitis over 15 years is possible with the conservative therapy and a quite restrictive use of antibiotics.

Survival of questionable and hopeless teeth

Survival rates after periodontal treatment are well documented in the literature, and tooth loss in studies with at least ten years of SPT are shown in Table 4. However there is a lack of studies on patients younger than 35 years presenting a history of aggressive periodontitis.

In the study of McGuire &Nunn (1996a) 45% of questionable and 38% of hopeless teeth survived over a period of SPT lasting 10 years. In the present study the proportions of teeth surviving were higher with 88% of questionable and 60% of hopeless teeth in patients with aggressive periodontitis surviving over a period of SPT lasting 15 years. The rate of tooth loss in the study of McGuire & Nunn (1996b) was 0.13 teeth per patient and year, which is similar to the current study results for the AgP (0.14) as well for the CP (0.16) group.

Gunsolley et al. (1995) re-examined 88 of from 327 patients with localized and generalized AgP in a 15-year follow up. The treatment of the patients consisted almost exclusively of either scaling and root planing or scaling with open flap curettage. Only a few patients received antibiotics, and the authors pointed out, that hopeless teeth were not removed during initial therapy. In their cohort, the time that elapsed since the most recent visit for patients was approximately three to four years. They reported that patients with severe generalized AgP had lost periodontal attachment. The rate of tooth loss experienced in their study was 0.29 teeth per year in patients over a 15-year observation period, which is about 2-3 times higher than shown in the comparable studies in table 4. Gunsolley et al. (1995) presumed that the cause for the comparatively high rate of tooth loss could be linked to the irregular SPT and/or the termination thereof. Eickholz et al. 2008 and Pretzl et al. 2008 examined patients 10 years after initiation of periodontal therapy. In those with irregular SPT 21% of questionable and 39% of hopeless teeth versus 3% of questionable and 14% of hopeless teeth in the group of regular SPT were lost. However, differences in the definition of what constituted regular SPT is make it difficult to compare these outcomes.

Studies, especially those by Hirschfeld & Wasserman (1978), McGuire & Nunn (1996b) and Fardal et al. (2004), have shown that only a small number of patients are responsible for the majority of tooth loss. In a later paper, Fardal & Linden (2008) reported that only 2% of patients lost 4-16 teeth. In the present study, patients do not show such a distinct pattern with tooth loss more widely distributed among the patients. This can be explained by the fact that only patients, presenting at least two teeth with severe bone loss were initially included and so the risk of tooth loss was distributed throughout to the patients studied.

PPD follow-up and reason for extraction

The study failed to detect statistically significant differences in the follow-up of the mean PPD between predicted questionable and hopeless teeth as well as between AgP and CP. One reason for this could be that an increase in the PPD with the resulting tooth loss for periodontal reasons was found in only a limited number of teeth. Actually, in the present study during SPT, 7.4% (CP: 5.8%) of all teeth were removed for periodontal reasons. Tooth loss due to periodontal reasons varied from 1.5% (König et al. 2002a, Fardal. et al 2004) to 9.8% (McFall et al. 1982) and, in a review of 13 long-term studies by Chambrone et al. (2010), 6.8% of all teeth present were extracted due to periodontal reasons. It is known that teeth were extracted due to periodontal as well as to other causes, ranging from endodontic complications, root fractures, caries, to prosthetic reasons, i.e., the loss of crown retention or unknown reasons, or because of treatment philosophies (Lundgren et al. 2008).

It has been suggested that teeth with a predicted questionable prognosis due to severe bone loss should not be treated periodontally, but rather extracted early instead to avoid a deterioration of the local bone volume and eventual involvement of neighbouring teeth. Machtei & Hirsch (2007) showed in a study on 90 patients, that radiological bone fill could be achieved after periodontal treatment of so-called questionable teeth with any no negative effects on neighboring teeth. However, in retrospective studies, it is difficult to clearly determine the reason for extraction. We thus decided only to differentiate extractions based on periodontal reasons and other reasons. If teeth were extracted *alio loco*, we researched into and attempted to determine the cause thereof. The mean time for survival of questionable teeth until extraction were 4.5 (AgP) 5.9 (CP) years (hopeless: 3.9/4.0) (Table 3). It is obvious that the more teeth had been extracted during APT the fewer teeth can be extracted during STP. The above results show that the teeth, which were not immediately extracted during APT, did in fact have a chance of being saved until the treating physician decided to extract them.

As far as treatment planning is concerned, Lundgren et al. (2008) emphasized that the date of extraction can play a decisive role in the patients quality of life. It makes sense that an early extraction of a putatively questionable tooth in a 40 year old patient with a life expectancy of 80 years is perhaps the beginning of a time consuming and expensive prosthetic treatment for the next 40 years (Pretzl et al. 2009). For this reason, treatment of strategically important teeth is—in spite of their potentially limited predicted prognosis—a meaningful goal.

Conclusion

Our retrospective study in 68 patients demonstrated that, in patients with a history of aggressive periodontitis, 88.2% questionable teeth survived 15 years of supportive periodontal therapy. The survival rate of predicted hopeless teeth was significantly lower, only 59.5% survived over this time

period. In our study, we did not find any significant differences either in tooth survival between aggressive and chronic periodontitis or in the follow-up of PPD. Most teeth were extracted for periodontal reasons. In aggressive periodontitis as well as in chronic periodontitis, treatment of periodontally compromised teeth with advanced bone loss is a meaningful therapeutic approach to prevent tooth loss with the consequence of prosthetic rehabilitation.

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Figure legends

Fig. 1. Recruitment of AgP patients

Fig. 2. Questionable teeth. Follow-up of mean PPD during supportive periodontal therapy starting at baseline (BL) to the 15th year of SPT. No statistical difference in PPD between AgP and CP. Error bars show maximium and minimum PPD.

Fig. 3. Hopeless teeth. Follow-up of mean PPD during supportive periodontal therapy starting at baseline (BL) to the 15th year of SPT. No statistical difference in PPD between AgP and CP. Error bars show maximium and minimum PPD.

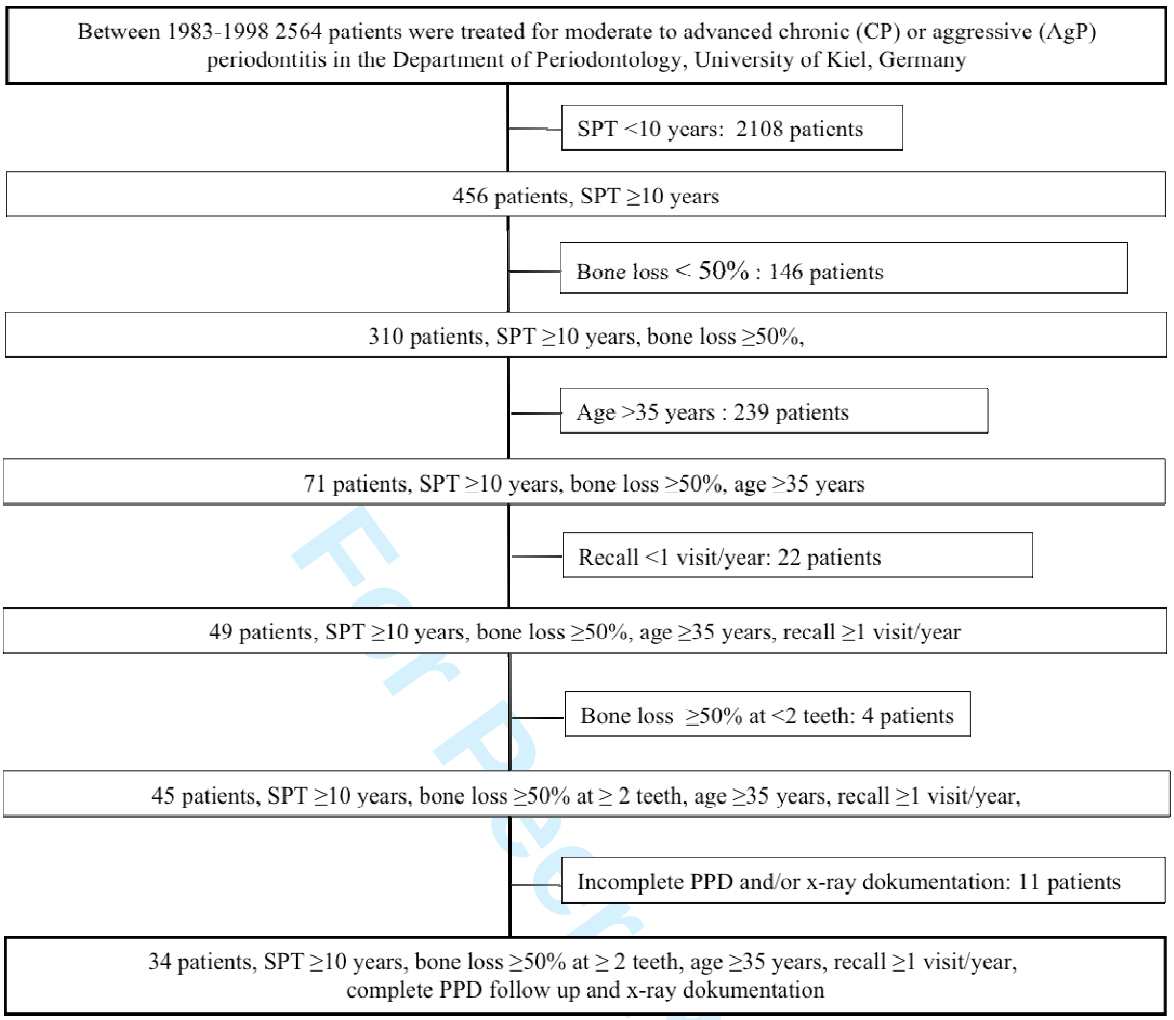
Tables

Table 1. Demographic data, plaque score, observation period, pocket probing depth, antibiotic therapy

Table 2. Number of teeth before and after APT and at the end of SPT

Table 3. Mean time for tooth survival and reasons for tooth loss

Table 4. Comparison of data from the present study and other retrospective studies with an observation period of approximately ten years of supportive therapy



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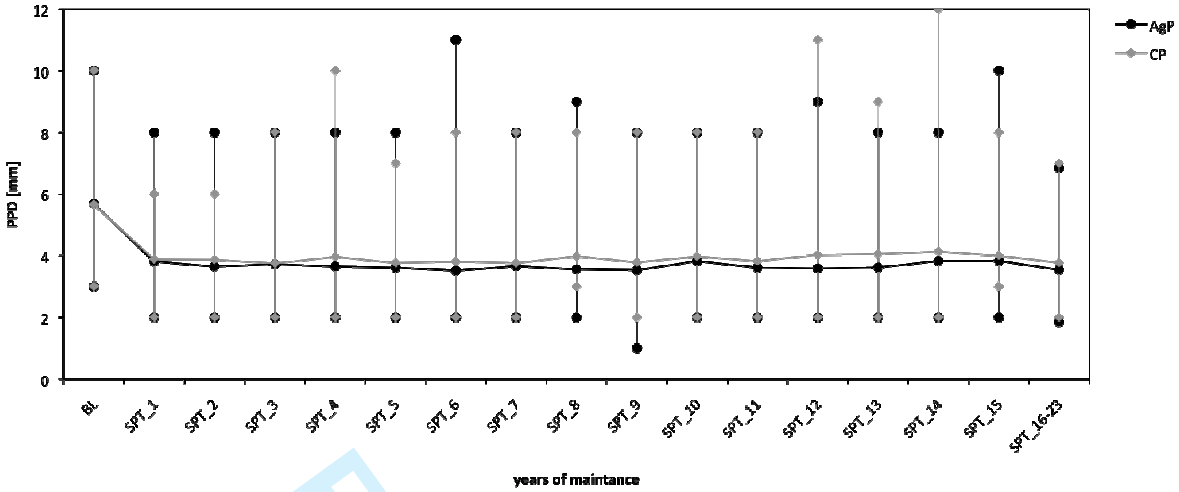

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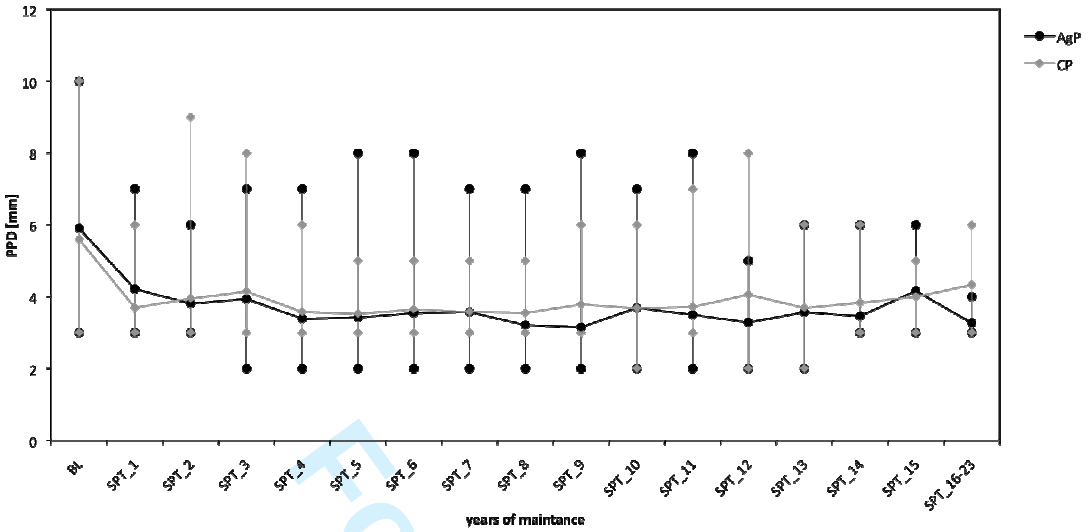

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Table 1. Demographic data, plaque score, observation period, pocket probing depth, antibiotic therapy

	AgP	CP
Number of patients	34	34
Gender (male/female)	23/11	17/17
Smoker/Former smoker/Non-smoker	8/5/26	4/4/30
Mean age ± SD (years) at baseline	33.3 ± 4.1 range 23-42	51.6 ± 7.4 range 40-69
Patients with localized / generalized periodontitis	2/32	3/31
Number of teeth with bone loss (T0) <50% / ≥50 to <70 / ≥70% of bone loss	598/262/63	674/149/51
Mean Plaque (%) at baseline (T0)	47.00±20.29	60.58±24.16
Mean Plaque (%) during SPT (T1-T2)	24.32±16.37	34.18±20.91
Observation period APT and SPT (T0-T2, years)	16.1 ± 4.5	16.3 ± 4.1
Observation period SPT (T1-T2, years)	15.3 ± 4.1	15.7 ± 3.6
Mean pocket probing depths (mm)		
Baseline (T0)	6.5±2.2	5.9±1.9
after APT (T1)	3.9±1.3	3.6±1.0
at end of SPT (T2)	3.6±1.2	3.5±1.2
Number of patients with antibiotic therapy in APT/SPT	6/4	0/0

APT: active periodontal therapy; SPT: supportive periodontal therapy. AgP: aggressive periodontitis; CP: chronic periodontitis.

Table 2. Number of teeth before and after APT and at the end of SPT

	AgP	CP
No. of teeth present before APT (T0)	923	874
No. of teeth present after APT (T1)	853	834
No. of teeth present at end of SPT (T2)	781	741
No. of teeth/patient present before APT (mean± SD)	26.8 ± 3.0 range 20-32	24.9 ± 3.5 range 17-31
No. of teeth/patient present after APT (mean± SD)	25.5 ± 3.3 range 18-32	22.1 ± 5.2 range 9-31
No. of teeth/patient at end of SPT (mean± SD)	22.6 ± 3.9 range 12-31	19.9 ± 5.2 range 9-28
No. of questionable teeth/patient before APT (mean± SD)	7.0 ± 4.5 range 0-18	2.6 ± 2.2 range 0-8
No. of hopeless teeth/patient before APT (mean± SD)	2.6 ± 2.9 range 0-11	0.7 ± 1.4 range 0-7
No. (%) of questionable teeth lost during APT (T0-T1)	25 (9.5)	12 (8.1)
No. (%) of hopeless teeth lost during APT (T0-T1)	26 (41.3)	16 (31.4)
No. (% of the remaining teeth) of teeth with predicted questionable prognosis lost during SPT (T1-T2)	28 (11.8)	28 (20.4)
No. (% of the remaining teeth) of teeth with predicted hopeless prognosis lost during SPT (T1-T2)	15 (40.5)	12 (34.3)

APT: active periodontal therapy; SPT: supportive periodontal therapy. AgP: aggressive periodontitis; CP: chronic periodontitis.

Table 3. Mean time for tooth survival and reasons for tooth loss

	AgP	CP
Mean time for survival of teeth with bone loss<50% until extraction during SPT	7.5±6.7 range 1-23	5.7±3.9 range 1-17
Mean time for survival of predicted questionable teeth until extraction during SPT	4.5±6.2 range 1-23	5.9±5.0 range 1-17
Mean time for survival of predicted hopeless teeth until extraction during SPT	3.9±6.3 range 1-23	4.0±4.7 range 1-15
Teeth loss due to periodontal reasons during SPT (APT)	63 (49)	48 (28)
Teeth loss due to periodontal reasons of predicted questionable / hopeless teeth during SPT and APT	43/17	26/16
Patient (%) who lost 0/1-3/4-6/>6 teeth from a total of 923 (AgP) and 874 teeth (CP)	21/35/15/29	15/35/29/21
No. of non-molars lost during APT (SPT)	33 (25)	15 (44)
No. of molars (M1/M2) lost during APT (SPT)	26 (36)	19 (31)
No. of third molars lost during APT (SPT)	11 (11)	6 (18)
Mean tooth loss per year/patient from a total of 923 (AgP) and 874 teeth (CP)	0.14	0.16

APT: active periodontal therapy; SPT: supportive periodontal therapy. AgP: aggressive periodontitis; CP: chronic periodontitis.

Table 4: Comparison of data from the present study and other retrospective studies with an observation period of approximately ten years of supportive therapy

Studies	Number of patients	Mean Age	Mean years in SPT	Tooth loss during SPT (%)	Tooth loss per patient and year
Hirschfeld & Wasserman 1978	600	42	22	8.3	0.08
Mc Fall 1982	100	43.8	15	11.3	0.14
Goldman et al. 1986	211	41.8	22	13.4	0.17
Wood et al. 1989	63	45	13.6	7.1	0.13
McGuire et al. 1996b	100		9.97	5.2	0.13
Checchi et al. 2002	92	45	6.7	2.2	0.07
König et al. 2002a	142	46	10.5	3.0	0.07
Fardal et al. 2004	100	46	9.8	1.5	0.04
Leung et al. 2006	97	40.6	8.9	10.2	0.25
Chambrone & Chambrone 2006	120	40.6	17.4	3.8	0.05
Faggion et al. 2007	198	47.6	11.8	5.5	0.11
Pretzl et al. 2008	100	46.5	10	6.7	0.15
Matuliene et al. 2008	172	45	9.5	6.5	0.17
Bäumer et al. 2011	84 (AgP)	30.8	10.5	5.2	0.13
Present study	34 (AgP) 34 (CP)	33.3 51.6	15.3 15.7	8.4 / 11.8* / 40.5** 11.2 / 20.4* / 34.3**	0.14 0.16

SPT: supportive therapy; AgP: aggressive periodontitis; CP: chronic periodontitis; * predicted questionable teeth; **predicted hopeless teeth