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ORIGINAL ARTICLE

Treatment compliance in patients with aggressive periodontitis – a retrospective case-control study

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ABSTRACT

Objective: To investigate if differences according to discontinuation of treatment could be identified between patients with aggressive periodontitis and chronic periodontitis at two specialist clinics of periodontology irrespective of the effects of background factors.

Materials and methods: This is a retrospective case-control study. The variables were registered from dental records. The population consisted of patients referred to two specialist clinics of periodontology during three years. A study group was included consisting of 234 patients with a diagnosis of aggressive periodontitis. A control group with a diagnosis of chronic periodontitis was randomly selected.

Results: In total, 234 patients (4% of the referrals) with a diagnosis of aggressive periodontitis were referred to the two periodontal clinics during a period of three years. Forty-two per cent of the non-compliant patients were smokers compared to 31% for the compliers and this difference was statistically significant. Patients with aggressive periodontitis interrupted their periodontal treatment significantly more frequently (46%) compared to those patients with chronic periodontitis (34%). The non-compliant patients had significantly deeper periodontal pockets at baseline as well as significantly more sites with bleeding at probing. In a stepwise logistic regression analysis, aggressive periodontitis, smoking and the relative frequency of sites with periodontal pockets >4 mm at baseline were the remaining variables with a significant influence on the incidence of interrupting ongoing periodontal treatment.

Conclusions: The patient group with aggressive periodontitis interrupted the periodontal treatment significantly more often irrespective of background factors and risk factors, which may be regarded as a major health problem.

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Introduction

Periodontitis is a destructive form of periodontal disease characterized by inflammation of the periodontal tissues. The inflammatory disease is caused by microorganisms colonizing the root surface, and the host response to the microbial infection causes damage to the periodontal tissues.[1] The clinical features of periodontitis are dependent on the inflammatory host reactions modified by the immune response and several risk factors.[2] Smoking and diabetes mellitus are known today as the most important risk factors.[3]

Periodontitis is divided into two main groups; chronic and aggressive periodontitis.[4] Each disease in turn is divided into two forms; localized and generalized. Epidemiological studies demonstrate that a majority of adults show local signs of chronic periodontitis while aggressive periodontitis is an unusual periodontal disease compared to chronic periodontitis (for review, see [5]), with a prevalence between 0.5% and 5% depending on place of origin.[6] Chronic and aggressive periodontitis share many clinical similarities but there are also significant differences. Clinical deviations include the age of onset, rate of progression, pattern of destruction, clinical signs of inflammation and the amount of plaque and calculus.[7] Aggressive periodontitis comprises a group of rare, often severe, rapidly progressive forms of periodontitis.[6] The afflicted individuals are otherwise healthy. The onset is often at an early age with familial aggregation.[2] The degree of clinical inflammation is considered to be less intense in the localized aggressive form of periodontitis when compared to the generalized form or chronic periodontitis.[7]

A high degree of patient compliance during the periodontal treatment phase is a prerequisite for a successful treatment outcome.[8] However, noncompliance and dropout from periodontal treatment has been reported to be frequent (for review, see [9]). In a study investigating the Swedish dentists' perceptions of their patients, 40% of the dentists reported that 'missing/being late for appointments' was a problem at least once a day.[10] The complete compliance rate according to oral hygiene has been reported to be lower than 50% and especially for interproximal cleaning.[11] Patients who follow maintenance programme loose significantly fewer teeth compared to noncompliant patients.[12–14] The reasons of failure to comply might

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depend on many factors such as self-destructive behaviour, dental fear, economy, stressful events and the experience of unconcerned dentists.[9]

Earlier studies have reported that smokers had significantly lower compliance rates during supportive periodontal treatment compared to non-smokers.[15–17] In addition, the frequency of noncompliant patients was significantly higher among those with more severe chronic periodontitis.[16] The main aim of the present study was to investigate if differences according to discontinuation of treatment could be identified between patients with aggressive periodontitis and chronic periodontitis at two specialist clinics of periodontology irrespective of the effects of background factors such as smoking and the degree of periodontitis.

Materials and methods

This is a retrospective longitudinal study on a population consisting of patients referred to two specialist clinics of periodontology in Stockholm (Public Dental Services at Kista and Skanstull) during the time period from the first of January 2006 to the end of December 2008. The follow-up period lasted until December 2013. The study variables were registered from dental records. During this three-year period, twelve periodontitis worked at the two clinics and provided the clinical examinations and treatments. Patients with the diagnosis aggressive periodontitis were included in the study group. A control group of patients referred to the same clinics and with a diagnosis of chronic periodontitis was randomly selected from the database of dental records from the same time period. The study has been conducted in full accordance with the World Medical Association of Helsinki and was approved by the Regional Ethics Board in Stockholm (2013/1481-31/4). Informed consent from the participants was not obtained since the data were made anonymous before included in the data base. The study followed the 'Strengthening the Reporting of Observational studies in Epidemiology' (STROBE) checklist.

A power calculation with the following assumptions was performed: a power of 0.80, significance level of 0.05 and a difference in interruption of treatment of 8% between aggressive and chronic periodontitis. The calculation showed that at least 200 patients in each group were required. During the investigated time period, 5728 referrals were sent to the two periodontal clinics. Of those, 234 patients had a diagnosis of aggressive periodontitis and were included in the study group. Consequently, the same number of patients with a diagnosis of chronic periodontitis (control group) was randomly selected from the same time period. The following variables were registered from the medical records at baseline:

- Diagnosis was based on the following common features:
  - Aggressive periodontitis: usually affecting young individuals, clinically healthy except for periodontal disease, rapid attachment loss or bone loss, familial aggregation
    - Local: localized to permanent first molars and incisors, often a low level of gingival inflammation
    - General: affecting at least three permanent teeth other than first molars and incisors, often a high degree of gingival inflammation
  - Chronic periodontitis: slowly progressive disease, often complex and thick deposits of plaque and calculus on affected tooth sites
    - Local: $\leq$30% of sites affected
    - General: $>$30% of sites affected
- Age
- Gender
- Smoking habits (non-smoker, former smoker, current smoker)
- Number of teeth
- Distribution of periodontal pockets bleeding on probing (BOP) deeper than 4 mm and deeper than 6 mm measured at four sites/tooth (mesial, buccal, distal, palatinal/lingual)
- Percentage of periodontal pockets bleeding on probing measured at four sites/tooth (mesial, buccal, distal, palatinal/lingual)

Outcome variable: Interruption of periodontal treatment (no, yes).

Statistical analysis

Descriptive statistics and statistical analyses were performed using a statistical package (IBM SPSS Statistics 21.0; SPSS Inc., Chicago, IL, USA). In all analyses, the statistical computational unit was at subject level. Chi-square analyses or Fischer's exact test were used in order to analyse differences between groups according to categorical variables, while *t*-tests were used for numerical variables. Stepwise logistic regression analysis at the individual level was used in order to study the influence of potential background factors on the incidence of periodontal treatment interruption. Results were considered statistically significant at $p < .05$.

Results

In total, 234 patients with a diagnosis of aggressive periodontitis were referred to the two periodontal clinics during a period of three years. During the investigated time period, a total of 5728 referrals were sent to the two periodontal clinics. Consequently, 4% of the referrals concerning periodontal diagnoses were diagnosed as aggressive periodontitis.

The mean age of patients with a diagnosis of aggressive periodontitis was 29 years (range 20–43, Table 1) compared to a mean age of 53 (range 33–72) for the group of patients with chronic periodontitis. The frequencies of smokers as well as former smokers were significantly higher for subjects with chronic periodontitis (Table 1). In addition, smoking was significantly more common among those with the diagnosis chronic periodontitis irrespective of age.

The means (SD) according to investigated variables for compliant and non-compliant patients are presented in Table 2. Males interrupted the periodontal treatment more

Table 1. Distribution according to age, gender, smoking habits and discontinuation of treatment.

Diagnosis	N	Age (mean, range)	Gender (% males/ % females)	Percentage of current smokers	Percentage of former smokers	Discontinuation of treatment (%)
Local aggressive periodontitis	134	27 (20–43)	37/63	21	7	40
General aggressive periodontitis	100	31 (20–42)	47/53	36	9	55
Local chronic periodontitis	75	52 (33–66)	11/89	29	28	24
General chronic periodontitis	159	53 (40–72)	42/58	51	19	38
Total	468	41 (20–72)	36/64	35	15	40

Table 2. Means (SD) according to investigated variables for compliant and non-compliant patients.

Variable	Compliers ($N = 281$)	Non-compliers ($N = 187$)	p
Age	42 (15)	38 (14)	NS
Males (%)	33 (47)	41 (49)	NS
Smokers (%)	31 (46)	42 (50)	<0.05
Diagnosis aggressive periodontitis (%)	45 (50)	58 (49)	<0.01
Number of teeth at baseline	26.1 (4.7)	26.5 (3.2)	NS
Relative frequency (%) of BOP sites at baseline	34 (22)	43 (26)	<0.01
Relative frequency (%) of sites with periodontal pocket depths >4 mm at baseline	61 (49)	91 (70)	<0.001
Relative frequency (%) of sites with periodontal pocket depths >6 mm at baseline	16 (22)	26 (33)	<0.001

Table 3. Distributions (%) of number of months between baseline and interruption of treatment for patients with chronic and aggressive periodontitis.

Number of months	Chronic periodontitis	Aggressive periodontitis
0–12	49	62
13–24	22	11
25–36	6	15
37–48	18	6
49–60	5	5
>60	0	1

often compared to females. However, this difference was not statistically significant ($p = .09$). Forty-two per cent of the non-compliant patients were smokers compared to 31% for the compliers and this difference was statistically significant ($p < .05$). Patients with aggressive periodontitis interrupted their periodontal treatment more frequently (46%) compared to those patients with chronic periodontitis (34%). This difference was statistically significant ($p < .01$, Table 2). The non-compliant patients had significantly deeper periodontal pockets at baseline ($p < .001$) as well as significantly more sites with bleeding at probing ($p < .01$).

Out of those patients who interrupted the periodontal treatment, a majority (62%) interrupted the ongoing periodontal treatment within the first 12 months, while the corresponding frequency was 49% for patients with chronic periodontitis (Table 3). The time elapsed between baseline and interruption of treatment did not differ depending on periodontal diagnosis.

Subjects with aggressive periodontitis had significantly more sites with periodontal pockets >4 mm or >6 mm at baseline compared to patients with chronic periodontitis ($p < .001$). The non-compliant patients with chronic periodontitis had significantly deeper periodontal pockets and more sites with bleeding on probing compared to the compliant subjects with chronic periodontitis (Table 4). Patients with aggressive periodontitis who interrupted the periodontal treatment had significantly more periodontal pockets with probing depths >6 mm (Table 4).

In a stepwise logistic regression analysis, aggressive periodontitis, smoking and the relative frequency of sites with periodontal pockets >4 mm at baseline were the remaining variables with a significant influence on the incidence of interrupting ongoing periodontal treatment (Table 5).

Discussion

In the present study, 234 patients had a diagnosis of aggressive periodontitis, corresponding to a prevalence of 4%. Consequently, the great majority of the patients treated for periodontitis in these two specialist clinics had a diagnosis of chronic periodontitis. No comparative studies in the literature according to the prevalence of aggressive periodontitis in periodontal clinics were found. However, the prevalence of patients with aggressive periodontitis in the present study may be biased for several reasons. It may be difficult to differentiate between generalized chronic severe periodontitis and generalized aggressive periodontitis based on clinical criteria. The progression rate of the disease is one of the main criteria used to distinguish between the two forms of periodontal disease, and lack of information regarding earlier clinical and radiographic data may prevent a correct diagnosis especially since this is a retrospective study.

There was a significant difference between the groups with regard to age and gender, with a higher proportion of females. Patients with aggressive periodontitis were significantly younger than those with chronic periodontitis, which corresponds well with the characteristics of this diagnosis.[7] In the present study, the frequency of female patients was higher than male patients. This result is also in accordance with earlier studies at the same clinic.[16,18] The fact that there were significantly more females in both groups with periodontitis does not necessarily mean that the diseases affect females more often, but that females more often seek care.[19] In the present study, the percentage of females was higher in the group of patients with aggressive periodontitis compared to those with chronic periodontitis. However, in

Table 4. Distributions according to the relative frequencies (%) of BOP sites (A), periodontal pocket depths >4 mm (B) and >6 mm (C) at baseline for compliant and non-compliant patients.

A.

	Chronic periodontitis		Aggressive periodontitis	
Number of BOP sites	Compliers*	Non-compliers*	Compliers	Non-compliers
0–10	20	14	15	8
11–20	6	9	15	11
21–30	26	17	15	12
>30	48	60	55	69

B.

	Chronic periodontitis		Aggressive periodontitis	
Number of periodontal pocket depths >4 mm	Compliers**	Non-compliers**	Compliers	Non-compliers
0–10	46	40	43	21
11–20	38	23	23	21
21–30	11	10	10	23
>30	5	27	24	35

C.

	Chronic periodontitis		Aggressive periodontitis	
Number of periodontal pocket depths >6 mm	Compliers**	Non-compliers**	Compliers*	Non-compliers*
0–1	50	31	86	23
2–3	13	31	8	17
4–5	20	5	3	14
>5	17	33	3	46

*$p < .05$,
**$p < .001$.

Table 5. The results of stepwise logistic regression using discontinuation of treatment as the dependent variable.

Independent variables	Odds ratio	Confidence interval	*p*
Relative frequency of sites with periodontal pocket depths >4 mm at baseline	2.1	(1.5; 3.0)	<.01
Aggressive periodontitis	1.7	(1.1; 2.5)	.01
Smoker	1.6	(1.1; 2.5)	.02

Independent variables were included in the model if $p < .05$, $N = 468$.

most populations no significant differences between genders according to prevalence of aggressive periodontitis have been found.[20]

Subjects with aggressive periodontitis had significantly more sites with periodontal pockets >4 mm or >6 mm at baseline compared to patients with chronic periodontitis. Thus, the results showed that the subjects with aggressive periodontitis had a more severe and widespread periodontal disease.

Individuals with generalized aggressive periodontitis and smokers were the groups who most often experienced interruptions during the periodontal treatment. This information is important since it means that a large portion of the patient group with the most severe periodontal disease or having an important risk factor did not fulfil the treatment plan. An earlier study at the same clinic investigated the relationship between periodontal status and the tendency to interrupt periodontal treatment and to determine whether smoking had a significant impact on this association.[16] A great majority of the patients in that study hade chronic periodontitis and they found that smokers and patients with the most severe chronic periodontitis most frequently interrupted periodontal treatment. Another study from the same clinic showed that more than 40% of smoking teenagers with extensive periodontal disease frequently dropped out from ongoing periodontal treatment.[21]

The age of the patients did not significantly differ between those patients who interrupted the periodontal treatment and those who fulfilled the treatment plan. However, the results according to the relationship between age and compliance differ between studies. In a study on patients in a clinic of preventive dentistry at Osaka University,[22] the compliance rate according to maintenance visits was significantly higher for older individuals compared to younger age groups and in a study from Brazil the risk for non-compliance was higher for age groups ≤40 years.[23] However, in a study from Italy,[24] the mean age of compliers was significantly lower than for non-compliers and younger patients from a private clinic in Greece had a significantly lower tendency to drop out.[25]

The tendency to interrupt ongoing periodontal treatment did not differ significantly between males and females. A previous retrospective study from Greece reported that complete compliance was significantly more common among females,[25] while no significant associations between compliance rate and gender were found in an Italian study as well as in an Australian study.[15,24]

Smokers dropped out from the periodontal treatment significantly more often than non-smokers. This result is in agreement with an earlier study at the same clinic [16] and two studies from Australia and Switzerland.[15,17] However, in one of the studies,[17] the significant association between

smoking and compliance did not remain after adjustment for confounders.

Patients with a higher frequency of deep periodontal pockets dropped out from the periodontal treatment significantly more often in agreement with two earlier studies from the same clinic [16,21] and an investigation from a private periodontal practice in Dallas.[26] However, in a study on patients with moderate to advanced periodontitis at a university clinic at Kiel [27] as well as in an Australian study,[15] the degree of periodontitis at baseline did not differ between compliers and non-compliers.

The overall frequency of non-compliers was 40% and for those patients with the diagnosis general aggressive periodontitis as high as 55%. A majority (62%) of the patients who interrupted the treatment dropped out during the first year of treatment. Frequencies of drop out for patients in university-based programmes were found to be 11% to 45%.[11] Besides, a great variation between clinics in South America according to compliance rate has been found.[28] Factors such as treatment strategy, knowledge of the importance of regular maintenance therapy, economic conditions and the attitude of dental hygienists and periodontitis may have influence on the compliance rate.

Medical studies have reported that even patients suffering from life-threatening diseases often fail to cooperate.[29,30] Periodontal disease is a chronic slowly progressive disease. Consequently, low compliance rates during treatment of periodontitis might be expected. The present study is the first report according to our knowledge investigating the compliance rate for patients with aggressive periodontitis irrespective the influence of confounding factors. Similar studies testing the same hypothesis on other populations are needed to draw conclusions about the generalizability of these results. The reasons for a positive correlation between interruption of treatment and treatment need are unclear. The duration of the treatment and the costs of treatment have been discussed as contributing explanatory factors in a review study,[31] which may be relevant to explain why patients with severe periodontitis and aggressive periodontitis drop out from ongoing treatment.

In conclusion, the patient group with aggressive periodontitis interrupted the periodontal treatment significantly more often irrespective of background factors and risk factors, which may be regarded as a major health problem.

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Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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