



Short communication

Number of teeth predict depressive symptoms in a longitudinal study on patients with periodontal disease



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ABSTRACT

Objective: Periodontal disease is associated with a wide range of psychosocial risk-factors. Disease-related tooth-loss has been associated with an increase in depressive symptoms in cross-sectional studies. However, while depression is a known risk-factor for the outcome of chronic diseases, it remains unclear if tooth loss can also predict depressive symptoms over the course of treatment. Aim of the current pilot study was to test, to what extent the number of teeth predict depressive symptoms several years later.

Methods: Tooth status of 310 patients with chronic and aggressive periodontitis was evaluated at the beginning of a specialized, university based outpatient treatment. We assessed depressive symptoms with the Patient Health Questionnaire (PHQ) on average 13 years later. Regression analyses were used to relate initial number of teeth to self-reported depression scores.

Results: Fewer teeth at the beginning of the treatment were related to higher scores of depressive symptoms, even when controlling for several covariates.

Conclusions: Tooth loss is a potential risk-factor for the development of depression in periodontal disease. Further longitudinal studies that control for initial depressive symptoms are needed to identify disease mechanisms.

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1. Introduction

One area of medicine that has received less attention in the field of psychosomatics is dentistry. This is surprising, given that in cross-sectional studies a high level of mental illness is associated with a variety of dental parameters [1]. A common and relevant dental condition is periodontitis [2,3], characterized by a chronic bacterial infection of the teeth-surrounding tissue that leads to an irreversible destruction of the periodontium, ultimately resulting in the loss of a significant amount of teeth [4]. Depression and periodontal disease can be considered bidirectional risk factors [5,6]. Particularly tooth loss affects self-efficacy through functional impairment, fear of stigmatization, and withdrawal from social life [7].

A number of studies tried to relate psychological variables, especially depression, to tooth loss in patients with periodontal disease. Positive associations were found in two large samples from the USA [8,9]. Similar results from different socioeconomic backgrounds, countries, and

assessment methods are reported by Persson et al. [10], Saman et al. [11], Coles et al., [12] and, less generalizable, by Urzua et al. [13], and Singh and colleagues [14].

However, other studies did not find an association between depression and tooth loss in patients with periodontitis. This was true for samples from Jordan [15], post-war Lybia [16], Japan [17], but also pregnant women from the USA [18]. A recent systematic review and meta-analysis came to the preliminary conclusion that based on the data available an association between depression and periodontitis cannot be confirmed. However, they called for more rigorous studies, including longitudinal ones [19].

Summing up, there is mixed evidence for a possible association between depression and tooth loss in periodontal disease. Furthermore, existing studies vary with regard to the assessment of dental status from simple self-report to expert examination. One of the key limitations of the published studies is their cross-sectional design. To our best knowledge there are no published studies that prospectively assess the impact of tooth loss on future depressive symptoms in periodontal disease. Aim of our pilot study was to address this question in a well diagnosed sample of patients with periodontitis.

2. Method, design, and sample

In a monocentric, prospective study from the Department of Conservative Dentistry and Periodontology at the University of Kiel, all patients

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between the age of 18 and 80 years of age with a history of aggressive (AgP; usually defined by an earlier onset, more rapid loss of clinical attachment/bone loss, and affecting families of otherwise systemically healthy individuals) and chronic periodontal (CP; commonly found in adults, and characterized as a slowly progressing disease with sometimes short periods of rapid progression) disease [4] were consecutively included in a study on the effectiveness of specialized treatment.² Periodontal treatment was carried out in accordance to a protocol [20,21], with complete periodontal assessment at baseline and the end of active periodontal treatment (APT). The treatment is covered by the German health care system. Initial periodontal status was assessed by pocket probing depth (PPD), clinical attachment level, and validated by X-ray. Dental status was recorded once a year during supportive periodontal therapy (SPT), including measurement of PPD at six sites per tooth. The last documented visit of the mostly ongoing treatments served as an endpoint for the current study. All patients who fulfilled the inclusion criteria were invited to fill out a set of questionnaires on psychosocial and health-related variables. The study protocol was approved by the local institutional review board (Kiel: D142/09). For a more detailed description see Graetz et al. [22].

3. Instruments

Depressive symptoms were assessed with the widely used depression (PHQ-9) and anxiety (GAD-7) module of the German version of the Patient Health Questionnaire [23,24]. In the same survey, patients answered questions on current sociodemographic status, diagnosed comorbid somatic diseases, oral hygiene, and smoking history or drug intake. All questionnaires were given blind to the dental status. To further ensure data integrity, they were returned to, prepared for analysis, and merged with the dental data at the non-treating site (Heidelberg). Patients were categorized as “never smokers”, “former smokers” (patients who had quit smoking for at least 5 years), and “current smokers” [25].

4. Statistical analyses

We predicted PHQ-9 values at the time of the study as a measure of current depression by the number of teeth at baseline as a longitudinal risk factor in a linear multiple regression analysis. We simultaneously controlled for some a-priori chosen covariates, such as age at baseline, smoking status, but also the number of comorbid somatic diseases and number of teeth at the time of the study to address the potential impact of current risk factors. In a second step, we examined some other variables in an explorative manner. Due to gender-differences in earlier findings [22], we repeated all calculations for men and women separately in addition to analyzing the overall sample. All analyses were conducted with IBM SPSS 23.

5. Results

Of the 812 patients, who were eligible with regard to in- and exclusion criteria, 734 could be contacted via mail. Of the 349 who returned the questionnaires, 310 gave their written informed consent to participate in the study. The sample consisted of 195 women and 115 men, with a mean age of 61.2 (10.5) years; 10.3% identified as smokers, 50.7% as former smokers, and 39.0% as never having smoked. Age at the first examination was 47.5 (10.3) years. Of all the participants, 26.5% reported no comorbid somatic disease condition, 62.9% one or two, and 10.6% three or more somatic diseases, with a range of up to six. Diseases comprised coronary artery diseases (N = 138), thyroid diseases (N = 54), diseases of the respiratory system (N = 31), renal

diseases (N = 26), diabetes (N = 15), infectious diseases (N = 14), and other diseases (N = 94), 13 patients had survived at least one myocardial infarction.³ Sixty-one percent took some kind of related medication. Mean treatment length was 13.7 (7.7) years (range 2–30).

Participants had a mean depression score of 4.7 (3.6) on the PHQ-9, with a range from zero to 21. GAD-7 scores were 3.6 (3.2), respectively, ranging from zero to 14. According to conventional scoring of the PHQ-D, 58.6% had no depression, 30.3% subclinical depressive symptoms, and 11.2% scores that indicate a major depressive disorder [26].

There was no significant difference with regard to the number of teeth at baseline between men (M = 25.8, sd = 4.2) and women (M = 25.4, sd = 4.0), but men were significantly older (M = 49.6, sd = 9.9) than women (M = 46.2, sd = 10.3). At the time of the study, men were less depressed (men M = 4.1, sd = 3.5 vs. women M = 5.0, sd = 3.7), and less anxious (men M = 2.8, sd = 2.7 vs. women M = 4.0, sd = 3.4) on their PHQ scores. Differences regarding the number of teeth at the time of the evaluation (men M = 21.6, sd = 6.3 vs. women M = 22.8, sd = 5.4) failed to reach a conventional level of significance.

In the overall sample, fewer number of teeth at baseline predicted higher levels of depressive symptoms at the time of study. Of the a priori chosen current risk factors, only the number of current somatic disease was positively associated with depression. Gender specific analyses found this association to be significant in the sample of men only. The amount of variance explained ranged from four (overall sample) to 11% (men only; see Table 1). In other words, and taking into account the unstandardized regression coefficients: in the whole sample, for every additional tooth at baseline, there is a decrease in PHQ depression score of -0.17 points at time of study. This decrease was larger for men (-0.23) than for women (-0.08). When adopting a stepwise approach entering number of teeth at baseline in a second step, and all other variables in the first, number of teeth added a significant amount of variance explained to the model in the overall sample (increase in $R^2 = 0.02$, $p = 0.03$), and the sample of men (increase in $R^2 = 0.04$, $p = 0.03$), but not for women (increase in $R^2 = 0.02$, $p = 0.49$). Adding age at the time of the study, diagnosis (aggressive vs. chronic periodontal disease), body mass index, tooth-loss, or treatment length did neither change the results nor improve the model. Adding GAD-7 anxiety scores did not change the pattern of results (number of teeth at baseline $b = -0.13$, $p = 0.02$, number of comorbid somatic diseases = 0.29, $p = 0.05$).⁴

6. Discussion

In a sample of 310 patients with periodontitis, the number of teeth at the beginning of a specialized, university based treatment predicted depressive symptoms >13 years later: fewer teeth were associated with higher levels of depression. This was true when controlling for a variety of covariates. The only other variable that was consistently related to depression was the number of comorbid somatic diseases. In addition, there was a strong gender influence, relating the overall effect to the male subsample.

³ For the 502 individuals not responding to the study, some basic data could be extracted from medical charts. The sample comprised 301 women and 201 men, had a mean age of 61.7 (12.1) years, the age at first examination was 48 (10.8) years. Of the not responding sample, 87.6% had some kind of comorbid somatic disease condition. Smoking status was as follows: current smokers 11.5%, former smokers 63%, and 25.5% were identified as never having smoked. There was no significant difference in age at first examination or at the time of study, or distribution of sex or individuals without any comorbid somatic disease. In the group of not responding patients, the proportion of former smokers was significantly higher than in the participants (chi-square = 16.7, $p < 0.001$).

⁴ When adding ECR-R [27] attachment scores as in Graetz et al. [22], the findings for number of teeth at baseline ($b = -0.19$, $p = 0.02$), and number of comorbid somatic diseases ($b = 0.13$, $p = 0.02$) still contributed significantly to the model. Predicting GAD-7 anxiety scores by the variables did not yield a significant model-fit (omnibus-test for the whole sample $p = 0.12$, for men $p = 0.30$, for women $p = 0.74$).

² To be included, patients furthermore had to have sufficient knowledge of the German language to be able to answer the questionnaires, were treated with at least a two-year follow-up of SPT. Exclusion criteria were absence of compliance with the inclusion criteria, absence of informed written consent, and a diagnosis of a severe acute pain syndrome.

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