

Impact of Periodontal Disease Experience on Oral Health–Related Quality of Life

Henrik Jansson,* Åsa Wahlin,* Veronica Johansson,† Sigvard Åkerman,‡ Nina Lundegren,‡ Per-Erik Isberg,§ and Ola Norderyd*||

Background: Periodontal research has traditionally focused on the site level, regarding etiology, pathogenesis, and treatment outcome. Recently, some studies have indicated that the presence of periodontal disease is associated with reduced quality of life. The aim of this study is to investigate the impact of periodontal disease experience on the quality of life.

Methods: This cross-sectional study includes 443 individuals. Clinical and radiographic examinations were performed; in conjunction, the oral health–related quality of life of all participants was assessed using the Swedish short-form version of the Oral Health Impact Profile (OHIP-14). Based on marginal bone loss, measured on radiographs, three different groups were identified: participants with loss of supporting bone tissue of less than one third of the root length (BL–), loss of supporting bone tissue of one third or more of the root length in <30% of teeth (BL), or loss of supporting bone tissue of one third or more of the root length in ≥30% of teeth (BL+).

Results: The effect of periodontal disease experience on quality of life was considerable. For the BL– group, the mean OHIP-14 score was 3.91 (SD: 5.39). The corresponding mean values were 3.81 (SD: 5.29) for the BL group and 8.47 (SD: 10.38) for the BL+ group. The difference among all groups was statistically significant ($P \leq 0.001$). A comparison among the mean OHIP-14 scores in the different groups (BL–, BL, and BL+) revealed significant differences in six of seven conceptual domains.

Conclusions: The BL+ individuals experienced reduced quality of life, expressed as the OHIP-14 score, compared with the BL and BL– participants. *J Periodontol* 2014;85:438-445.

KEY WORDS

Alveolar bone loss; health impact assessment; oral health; periodontal disease; periodontitis; quality of life.

Periodontitis is a result of an imbalance between the oral biofilm in the dento-gingival area and the host response. This imbalance results in a loss of supporting periodontal ligaments and alveolar bone.^{1,2} Improved oral health in the adult population in Sweden has resulted in fewer edentulous individuals and concomitantly more individuals with more remaining teeth.³ However, despite these improvements, ≈10% of the adult population suffers from severe periodontal disease.^{4,5}

Numerous clinical studies have focused on management of the disease in terms of etiology, pathogenesis, efficacy, and outcome of different treatment options. Focus has been on clinical variables such as probing depth (PD) and attachment level, and most studies have used a site perspective rather than an individual perspective. Periodontal disease will, as a result of inflammation and tissue breakdown, produce a wide range of clinical signs and symptoms. These will probably have an impact on the quality of life.⁶ However, few reports reveal the patients' perception of oral health and its influence and contribution to quality of life and overall well-being.⁷ This has led to the development of a number of instruments that aim to measure oral health outcomes, in terms of the impact of changes in oral health on quality of life in population-based studies.

* Department of Periodontology, Centre for Oral Health Sciences, Malmö University, Malmö, Sweden.

† Department of Oral Public Health, Centre for Oral Health Sciences, Malmö University.

‡ Department of Oral Diagnostics, Centre for Oral Health Sciences, Malmö University.

§ Department of Statistics, Lund University, Lund, Sweden.

|| Department of Periodontology, Institute for Postgrad Dental Education, Jönköping, Sweden.

There are different instruments to measure oral health-related quality of life. One of the most widely used is the Oral Health Impact Profile (OHIP).⁷ The original, long-form instrument measures how oral health affects individuals' quality of life using 49 questions. The short form, consisting of 14 questions (OHIP-14), has emerged as a powerful tool in the assessment of oral health-related quality of life.⁸ Due to its practicality, it has frequently been used in a variety of hospital settings and for a range of dental conditions.^{9,10} Studies have reported the impact of chronic periodontitis on physical comfort or other domains that affect quality of life.¹¹⁻¹³ There is a lack of large population studies, especially from the Scandinavian countries.

The aim of this study is to investigate the impact of periodontal disease experience on quality of life in a population in the south of Sweden, using the Swedish version of the OHIP-14 questionnaire.

MATERIALS AND METHODS

Ethical Requirements

The Medical Ethics Committee of Lund University, Lund, Sweden (ref. no LÜ 103-2006), approved the study in accordance with the Helsinki Declaration. All study participants gave their signed, informed consent before inclusion in the project.

The Sample

Skåne, a county in the south of Sweden, had in 2007 a population of 907,702 individuals aged 20 to 89 years old. Of these, 1,000 individuals were randomly selected from the Government's Person Address Register in Sweden and recruited for the Skåne Oral Health Survey.¹⁴ Of the original sample, 14 individuals had an unknown address, 11 had moved from the region, and nine were deceased, thus leaving 966 individuals as the final sample. Four hundred and fifty-one individuals (219 males, aged 20 to 89 years; mean age: 49.3 years; and 232 females, aged 20 to 88 years; mean age: 48.0 years) agreed to participate in the study.

The study was conducted at the Faculty of Odontology, Malmö University, Sweden, with the purpose of evaluating the oral health need and demand for dental care in the region. Each participant first answered a questionnaire, after which clinical and radiographic examinations were performed.

The Questionnaire

The questionnaire was divided into different parts concerning patient perception of oral health, oral health care need, pain, use of oral health care, dental materials, and background. The questionnaire consisted of 58 questions.¹⁵

The OHIP-14 was used to assess the oral health-related quality of life.⁸ OHIP-14 is a self-completed questionnaire consisting of 14 items subdivided into

seven domains. The OHIP was constructed to measure social impacts of oral problems as a total score index, or in seven dimensions: functional limitation, physical pain, psychologic discomfort, physical disability, psychologic disability, social disability, and handicap.⁷ The seven conceptual domains are derived from the oral health model.⁶ Questions can be answered on a Likert scale: 0 ("never"), 1 ("hardly ever"), 2 ("occasionally"), 3 ("fairly often"), and 4 ("very often"). A Swedish version of the full-length questionnaire (OHIP-49) has been created and assessed regarding reliability and validity.¹⁶ In the present study, the short-form questions from the Swedish translation and the additive method of calculating scores were used.^{16,17}

When performing the statistical analysis, individuals who did not answer all 14 questions were excluded in the analysis of the total OHIP-14 score. However, in the analysis of each question all the given answers were included.

Clinical Periodontal Examination

The clinical examinations were performed from March 2007 to November 2008 and took place at the Faculty of Odontology at Malmö University and at three Public Dental Service clinics in Skåne, situated in Helsingborg, Kristianstad, and Ystad. The examinations were carried out by eight dentists (NL, Sigvard Åkerman, Lena Widerström, Bengt Götrick, Tore Hallmer, Roland Sundqvist, Bassam Fakhro, and Björn Axtelius) from the Department of Oral Diagnostics at the Faculty of Odontology, Malmö University. The majority of the examinations (90.5%) were carried out by four of the examiners (NL, SÅ, Lena Widerström, and Bengt Götrick). The examiners were coordinated regarding the diagnostic criteria through comprehensive written instructions, continual discussions, and clinical case discussions. A standardized examination protocol was used.

One part of the clinical examination was focused on periodontal aspects. From the periodontal examination, the following variables were analyzed.

Number of teeth. Third molars, root remnants, and dental implants were excluded in all measurements.

PD. Only sites with PD \geq 4 mm were registered. Measurements were made at four sites for all teeth: mesial, buccal, distal, and lingual. Probing was performed with a calibrated periodontal probe[¶] to the nearest millimeter (diameter of the probe tip was 0.5 mm with 1-mm increments).

Bleeding on probing. Full-mouth bleeding on probing (BOP) was registered in conjunction with periodontal probing.¹⁸

¶ PCP-UNC 157, Hu-Friedy, Chicago, IL.

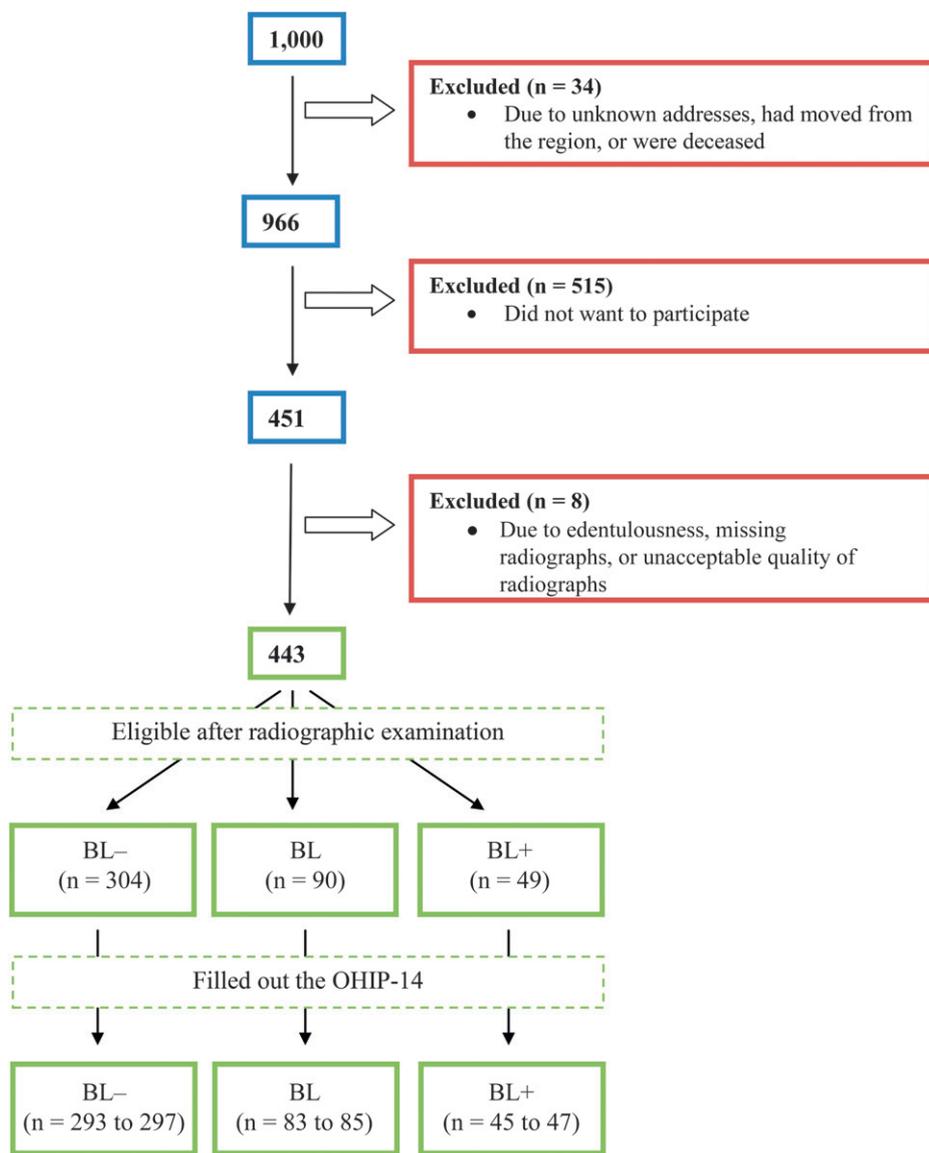


Figure 1. Patient selection flowchart. Some participants did not answer all of the OHIP-14 questions.

Radiographic Examination

Digital panoramic and four bitewing radiographs were taken on all participants. Marginal bone loss was analyzed in the radiographs in the manner described by Jansson et al.,¹⁹ by one calibrated examiner (ÅW).¹⁹ The examiner was masked and did not have access to any other information except the digital radiographs. Based on the radiographs, eight individuals were excluded: two participants were edentulous, one person was edentulous but with dental implants, radiographs were missing for four individuals, and in one individual the radiographs were of an unacceptable quality. The radiographs were classified into three different categories, according to marginal bone loss: 1) BL- = loss of

supporting bone less than one third of the root length; 2) BL = loss of supporting bone tissue one third or more of the root length in <30% of teeth; and 3) BL+ = loss of supporting bone tissue one third or more of the root length in ≥30% of teeth.

Statistical Analyses

For the non-response analysis, cross-tabulations were made concerning study non-participation versus age and sex. A logistic regression analysis was performed with response/non-response as the dependent variable. First, age and sex were entered into the model as independent variables.

By adding all scores 0 (“never”) to 4 (“very often”) for each question, the total OHIP-14 score ranges from 0 (no problems at all) to 56 (all problems experienced very often). Thus, a lower score indicates better oral health-related quality of life.

Means and standard deviations were calculated for the OHIP-14. Comparisons among groups were made using Pearson’s χ^2 test for categorical variables, analysis of variance for numerical variables (one-tailed), and Tukey test for multiple comparisons. A significance level of 5% was used in all tests. All analyses were made using statistical software.[#]

Reproducibility of Radiographic Measurements

To calculate intra-observer agreement, the assessments of the marginal bone level were repeated in 100 randomly chosen individuals, using κ statistics. The κ value was 0.8 and the weighted κ value was 0.87.

RESULTS

Study Population

After categorization according to marginal bone loss, the eligible number of individuals was reduced to 443 (because of edentulousness, missing radiographs, or unacceptable quality of radiographs): BL- (n = 304), BL (n = 90), and BL+ (n = 49) (Fig. 1).

SPSS v.18, IBM, Chicago, IL.

Table 1.
Characteristics (n [%] or mean \pm SD) of Participants Radiographically Assessed as BL⁻, BL, and BL⁺

Variable	BL ⁻	BL	BL ⁺	P
No. of individuals	304 (69)	90 (20)	49 (11)	
Sex				NS
Female	158 (52)	50 (56)	20 (41)	
Male	146 (48)	40 (44)	29 (59)	
Age (years)	42.5 \pm 15.4	59.9 \pm 11.4	64.4 \pm 11.8	≤ 0.001 *
Education				≤ 0.001 *
Primary school	47 (15)	30 (33)	18 (37)	
Secondary school	99 (33)	14 (16)	13 (27)	
Higher vocational education	37 (12)	18 (20)	9 (18)	
University	117 (38)	24 (27)	8 (16)	
Smoking	49 (16)	12 (13)	14 (29)	NS
No. of teeth	26 \pm 3.5	25 \pm 3.5	22 \pm 4.9	≤ 0.001
BOP (%)	28.1 \pm 19.7	27.9 \pm 19.1	34.8 \pm 27.2	NS
Sites with PD 4 to 5 mm (%)	5.4 \pm 7.5	8.5 \pm 8.2	21.2 \pm 18.2	≤ 0.001
Sites with PD ≥ 6 mm (%)	0.2 \pm 0.6	0.6 \pm 1.5	4.3 \pm 5.5	≤ 0.001 †
Individuals with BOP $\geq 20\%$ and PD ≥ 6 mm	34 (11)	22 (24)	26 (53)	≤ 0.001

NS = not significant.

* Statistically significant difference between the BL⁻ group and the BL and BL⁺ groups.

† Statistically significant difference between the BL⁺ group and the BL⁻ and BL groups.

Of those who did not participate in the clinical examination, 48% were women, and 52% were men. The largest non-participating group was men in the age group 30 to 39 years ($n = 46$). Ten percent stated that they were born in a country other than Sweden. Thus, the number of individuals born outside Sweden was lower in the non-participant group than in the participant group. In the non-participating group the percentage of university-educated individuals was 24%. More individuals in the non-participating group (10.9%) stated that they had a high number of missing teeth (missing >10 teeth) than in the group of participants in the clinical study (3.8%). This difference was significant ($P = 0.014$). There were no significant differences between the non-participants and the participants concerning perceived treatment need and satisfaction with one's teeth. The logistic regression analysis showed that there were significant ($P = 0.002$) differences in participation in the clinical study with regard to age. Individuals in the age group 80 to 89 years were less likely to participate (odds ratio = 2.82). There were no significant differences between the sexes.

Clinical Results

Table 1 illustrates the distribution of the participants according to number of individuals, sex, age, ed-

ucation, smoking habits, number of teeth, and periodontal conditions (BOP, percentage of sites with PD 4 to 5 mm and PD ≥ 6 mm, and number of individuals with BOP $>20\%$ and sites with PD ≥ 6 mm) in each group. Of the BL⁻ participants, 158 (52%) were female. The corresponding numbers in the BL and BL⁺ groups were 50 (56%) and 20 (41%), respectively. The comparison among BL⁻, BL, and BL⁺ subgroups (Table 1) revealed that a significantly lower percentage of BL⁺ and BL individuals had completed a university education, 17% and 28%, respectively, versus 39% for individuals in the BL⁻ group ($P \leq 0.001$). There were also significant differences among the BL⁻, BL, and BL⁺ subgroups concerning the number of remaining teeth (26, 25, and 22; $P \leq 0.001$), the percentage of sites with PD 4 to 5 mm (5.4%, 8.5%, and 21.2%; $P \leq 0.001$), the percentage of sites with PD ≥ 6 mm (0.2%, 0.6%, and 4.3%; $P \leq 0.001$), and the percentage of individuals with BOP $\geq 20\%$ and sites with PD ≥ 6 mm (11%, 24%, and 53%; $P \leq 0.001$).

Oral Health-Related Quality of Life

For the BL⁻ individuals, the mean of the total OHIP-14 score was 3.91 (SD: 5.39) (Table 2). The corresponding mean values were 3.81 (SD: 5.29) for the BL group and 8.47 (SD: 10.38) for the BL⁺

Table 2. Unadjusted Scores (mean ± SD) of OHIP-14 and Individual Domains of Individuals in the Three Levels of Marginal Bone Loss Experience

Domain	OHIP-14 Question	Marginal Bone Loss Experience (mean ± SD)			Statistics		
		BL- (n = 293 to 297)	BL (n = 83 to 85)	BL+ (n = 45 to 47)	Total (n = 421 to 429)	F	P
Functional limitation	Experienced worsened taste Had difficulties pronouncing words	0.44 ± 0.95	0.43 ± 0.99	0.89 ± 1.42	0.48 ± 1.03	4.12	0.017*
Physical pain	Experienced pain in the mouth Been unpleasant eating foods	1.27 ± 1.39	1.19 ± 1.39	1.79 ± 1.78	1.31 ± 1.45	3.03	NS
Psychologic discomfort	Felt insecure Felt tense	0.60 ± 1.29	0.48 ± 1.13	1.36 ± 2.25	0.66 ± 1.41	6.55	0.002*
Physical disability	Had an unsatisfying diet Had to interrupt meals	0.40 ± 0.84	0.31 ± 0.71	0.87 ± 1.58	0.43 ± 0.94	5.88	0.003*
Psychologic disability	Felt embarrassed Had difficulties relaxing	0.58 ± 1.13	0.61 ± 1.24	1.41 ± 2.11	0.68 ± 1.32	8.40	≤0.001
Social disability	Been irritated Had difficulties doing usual jobs	0.41 ± 0.98	0.39 ± 0.88	1.19 ± 1.61	0.49 ± 1.08	11.79	≤0.001
Handicap	Felt life being less satisfying Been unable to function	0.37 ± 0.87	0.41 ± 1.00	1.23 ± 1.89	0.47 ± 1.09	13.79	≤0.001
Total score		3.91 ± 5.39	3.81 ± 5.29	8.47 ± 10.38	4.38 ± 6.23	11.42	≤0.001

NS = not significant.

* Statistically significant difference between the BL+ group and the BL- and BL groups.

group. The difference among all groups was statistically significant ($P \leq 0.001$). A comparison among the OHIP-14 scores in the different groups (BL-, BL, and BL+), revealed significant differences in six of seven conceptual domains: functional limitation ($P = 0.017$), psychologic discomfort ($P = 0.002$), physical disability ($P = 0.003$), psychologic disability ($P \leq 0.001$), social disability ($P \leq 0.001$), and handicap ($P \leq 0.001$).

A multiple regression model was formulated by a forward stepwise analysis having the total OHIP-14 score as the dependent variable (Table 3). When including all individuals, the independent variables: 1) number of remaining teeth; 2) smoking; and 3) number of individuals with periodontal treatment need, expressed as having at least one PD ≥ 6 mm and at the same time full-mouth BOP $\geq 20\%$, had a statistically significant influence on the total OHIP-14 score. However, the coefficient of determination for this particular model was only 0.078.

DISCUSSION

The key finding in the present study is that the BL+ individuals experienced a worse quality of life compared with the BL- individuals. Today there is growing support for the existence of a correlation between the degree of periodontal disease and oral health-related quality of life. However, many studies have been conducted on children and adolescents, who have a low prevalence of marginal bone loss. This is the first large cross-sectional study (n = 443 individuals), and the study population is a random sample of the adult (ages 20 to 79 years) population in a larger geographic area in the southern part of Sweden (Region Skåne, n = 907,702). The result from the present study is in agreement with previous studies, which have found that loss of clinical attachment may have an impact on quality of life.^{12,13,20} Furthermore, a study investigating

Table 3.**Multiple Regression Analysis (n = 421) in Which the Dependent Variable Is the Total OHIP-14 Score**

Variable	Coefficient	95% Confidence Interval		P
		Lower Bound	Upper Bound	
Constant	13.898			
Age (years)	-0.035	-0.079	0.010	0.13
Smoking	1.925	0.285	3.564	0.022
No. of teeth	-0.394	-0.584	-0.203	<0.001
BOP \geq 20% and PD \geq 6 mm	1.829	0.257	3.401	0.023
Education				
Secondary school	0.305	-1.583	2.193	0.751
Higher vocational education	-1.249	-3.250	0.753	0.221
University	-0.368	-2.114	1.378	0.679

$R^2 = 0.078$.

the impact of periodontal disease on quality of life in individuals attending a private periodontal practice found that a broad range of physical, social, and psychologic aspects of quality of life were affected by periodontal disease.¹¹ In contrast, Biazevic et al.²¹ did not find that the prevalence of periodontal disease had any impact on the quality of life. However, their finding can perhaps be explained by the fact that the study population were adolescents and had a low prevalence of periodontal disease.

Regarding experience of physical pain due to the oral condition, no significant differences could be detected in the present study. This is in contrast to Saito et al.,²⁰ who reported a significant difference in experience of physical pain between individuals with or without periodontal disease at baseline. The difference in findings may, perhaps, be due to different oral health-related quality of life measurements being used, or to cultural differences among individuals in the study samples.

In the present study, a statistically significant difference is found between the BL+ and BL- groups regarding education level. This is in accordance with a recent systematic review and meta-analysis, which found that a low education level is associated with an increased risk of periodontitis.²²

There was no significant difference among the periodontal groups regarding smoking. However, smoking was significantly related to a decrease in oral health-related quality of life. Associations between smoking and reduced oral health-related quality of life have been found in multivariate analyses in other studies.²³⁻²⁹ However, there is a lack of knowledge as to what the association means. Tomar et al.²⁵ proposed that cigarette smoking may be ei-

ther an independent risk factor for reduced oral health-related quality of life or may serve as a marker for an underlying but unidentified factor. The nature of the association between smoking and reduced oral health-related quality of life needs to be investigated in future studies.

The body of evidence suggesting that periodontal therapy, non-surgical and/or surgical, is effective in establishing healthy periodontal conditions is convincing and has been well established in numerous clinical studies.³⁰⁻³³ However, most studies focus primarily on clinical outcomes, such as improvements in gingival inflammation, probing pocket reduction, and gain in clinical attachment level. In recent years, the study of patient-centered treatment outcome has been advocated, rather than site-centered outcome.^{34,35}

A weakness of the present study is the low response rate, 46%. Presumably, the participation rate would be related to how recent the individual's latest checkup was, general health, the need for a second opinion on dental status, and the oral treatment need. The shortage of individuals belonging to the oldest age group (80 to 89 year olds) among the examined participants may make the results for this particular age group uncertain. This age group is, however, well represented in the non-response questionnaire.

Another weakness of the present study may be that the outcome variable used to assess oral health-related quality of life, the short-form OHIP instrument, suffers from certain limitations such as a floor effect, i.e., a majority of scores accumulate at the bottom of the scale.³⁶ The highest mean OHIP-14 score found in this study was 8.47 for the BL+ group. In relation to the range of the OHIP-14, from

0 (indicating excellent oral health-related quality of life) to a possible 56, the mean is low. This may indicate that the patients with severe periodontal disease still experience their oral health-related quality of life as very good; however, it can also be an indication that the OHIP-14 does not fully capture the impact of periodontitis in relation to quality of life. However, although limited in certain aspects, the OHIP-14 has been found to discriminate between groups, for example, between persons with and without problems chewing, wearing dentures, having dry mouth, and with or without need for endodontic treatment.^{36,37} In this study, the OHIP-14 also discriminates among the different periodontal condition groups.

Further, the multiple regression analysis had a very low explanatory power, $R^2 = 0.078$. Thus, the independent variables included in the analysis did not constitute factors highly affecting the oral health-related quality of life. Further studies are needed to investigate what affects the quality of life in patients with periodontal disease.

One strength of the present study is that the prevalence of periodontal disease was largely in line with other studies from Sweden.^{4,38}

CONCLUSIONS

Individuals with severe marginal bone loss experienced worse quality of life compared with individuals with no/minor marginal bone loss. The result from the present study emphasizes the need for prevention and early treatment of periodontal disease, as severe periodontal bone loss has a negative effect on the individual's quality of life. There is a need for studies exploring whether periodontal treatment can improve quality of life in individuals with severe periodontal disease. Such studies could lead to a better understanding of patient demands and give the therapist the possibility to better tailor the treatment.

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- Correspondence: Assoc. Prof. Henrik Jansson, Department of Periodontology, Faculty of Odontology, Malmö University, SE-205 06 Malmö, Sweden. Fax: +46 40 6658405; e-mail: henrik.jansson@mah.se.
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