

ORIGINAL ARTICLE

Patient satisfaction 8–14 years after dental implant therapy – a questionnaire study

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ABSTRACT

Objective: The aim of this questionnaire study was to investigate patient satisfaction 8–14 years after dental implant therapy and complications influencing the degree of satisfaction.

Materials and methods: A questionnaire was sent by post to 587 patients at a specialist clinic of periodontology. The questionnaire consisted of 19 statements or questions such as the degree of satisfaction with the implants and knowledge of complications. In nine of the questions, respondents were asked to grade the extent of their agreement with a statement by selecting from fixed answers. Three of the questions were designed to be answered using a visual analog scale.

Results: In total, 400 individuals (81%) responded to the questionnaire. The mean time elapsed since implant installation was 10 years. A great majority (81%) experienced a high chewing comfort and was satisfied or sufficiently satisfied (94%) with the aesthetic aspects of their implant restorations, while 32% of the individuals had experienced problems with their implant reconstructions. The disadvantage that patients remarked on was the cost of the treatment. Those who had experienced problems with their implant reconstructions were also less satisfied with the treatment.

Conclusion: A great majority of the patients expressed a high degree of satisfaction with their dental implants 8–14 years after the treatment. Patients were less satisfied if they had experience of problems with their implant reconstructions and in cases when the clinicians were unable to resolve their complications.

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Introduction

Dental implant therapy expanded and became a widely accepted treatment modality in the early 1980s. However, the first publications about the use of titanium oral implants in humans were published as early as 1969.[1] Today, the use of dental implants has become an established routine therapy for replacing missing teeth. Substantial numbers of studies have reported high survival rates for edentulous patients after treatment with fixed implant-supported prosthesis as well as cases with single implants and partial dentures.[2–7] In a systematic review on single-tooth implants, the 5- and 10-year survival rates were estimated to be 96.3% and 89.8%, respectively.[8]

Long-term follow-up studies have demonstrated that the occurrence of complications with dental implants is frequent.[9–13] A previous study on implant survival and complication by the third European Association of Osseo-integration consensus conference concluded that only 66.4% of patients were completely free from any type of complications 5 years after dental implant therapy.[8] There is now a high level of consensus that the incidence of complications should be reported at patient level and not at implant level.[14,15]

Complications with dental implants are often classified as technical or biological. Minor technical complications such as abutment or screw loosening, small veneer fractures, and loss

of access-hole restoration are the most frequent and can be handled easily.[15] Abutment fractures and veneer or framework fractures can be considered moderately difficult to handle. Major technical complications such as implant fracture or loss of suprastructure demand major efforts and costs to resolve.[15] In a questionnaire study by Lam et al. (2014), oral health-related quality of life was scored 5 years post treatment with single implants.[16] Experience of complications and magnitude of complications decreased the quality of life.[16] The 10-year prospective cohort-study by Brägger et al. (2005) reported that 3.5–4.2% of patients lost their reconstruction due to technical complications.[17] The frequency of patients with surviving reconstruction with technical complications *in situ* was 31% for implant borne fixed partial dentures and 8.3% regarding single implants.[17] In a systematic review,[18] cumulative incidences of connection-related complications (screw loosening or fracture) and suprastructure-related complications (veneer and framework fracture) after 5 years were found to be 7.3% and 14%, respectively.

Biological complications are described as inflammatory lesions that develop in the tissues around implants.[19–21] In a recent systematic review, the estimated frequencies of peri-implant mucositis were 63.4% at individual level and 30.7% at implant level, and for peri-implantitis the corresponding frequencies were 18.8% and 9.6%, respectively.[22] In recent

years, maintenance therapy to prevent peri-implant diseases has become increasingly important, since peri-implant disease is a result of an imbalance between bacterial load and host defense. This approach is supported by a review article that demonstrated the positive effect of regular supporting treatment on success rates for implant treatment.[23]

Despite the high incidence of complications, biological and/or technical, knowledge is scarce regarding whether complications affect the degree of satisfaction with dental implant treatment in the long term. There are studies showing a high degree of patient satisfaction after dental implant therapy.[11,15,24–28] However, it is difficult to compare the degree of satisfaction between different studies, as the implant researchers have used non-validated tests and a standardized outcome measurement is lacking.[15] A high frequency of individuals have reported an improved chewing comfort after dental implant treatment.[11,25,27] In addition, a great majority of the dental implant patients experienced high aesthetic quality of the implant construction.[11,25] Still, there is a need for studies on patient-reported outcome measures (PROMs) with a long follow up, that is, >5 years, and where factors other than aesthetics and chewing ability are examined.

The aim of this questionnaire study was to investigate patient satisfaction 8–14 years after dental implant therapy at a specialist clinic of periodontology and complications/problems influencing the degree of satisfaction/quality of life. The hypothesis of this study is that the prevalence of self-perceived complications will affect the degree of satisfaction with dental implants.

Materials and methods

Patient material

All patients receiving dental implant therapy between 1999 and 2005 at a Specialist Clinic of Periodontology and Prosthetic Dentistry were included in this study. Patients were referred to the clinic either solely for dental implant therapy or for periodontal treatment followed by dental implant treatment. A power calculation showed that 400 participants were needed for power 80% and significance level 0.05. A total of 587 patients were identified; 79 of these patients had deceased before the study was performed. Questionnaires were sent by post to the remaining 508 patients. In 14 cases, the patients were unable to answer the questions due to severe illness. After 3 weeks, a reminder was sent to the 202 non-responders, and 68 additional questionnaires were answered. To reach a higher response rate, patients were contacted by telephone and offered a telephone interview. Contact was established with 28 patients, and interviews were conducted. Four hundred of the subjects responded to the questionnaire, a response rate of 81%. A flowchart of the participants is presented in Figure 1.

The surgical part of implant therapies was performed by dental specialists in periodontology. Seven periodontists were employed at the clinic during the study period. The patients were treated using one of three implant systems (Astra Tech TiOblast Microthread (Mölnådal, Sweden), Brånemark System

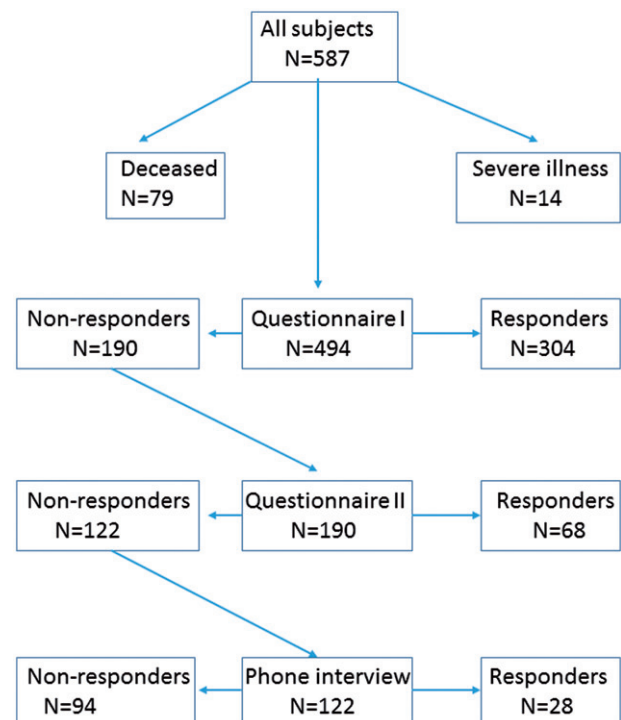


Figure 1. Flow chart describing the response rate of the questionnaires and phone interviews.

MkIII (Göteborg, Sweden), Straumann SLA Synocta (Basel, Switzerland)). Fifty-one per cent of the implant crowns were screw-retained and 48% were cement retained.

Questionnaire

The original questionnaire consisted of 28 statements or questions and 19 out of these have been used in the present study. In 9 of the questions respondents were asked to grade how much they agreed with the statement by choosing among 3–5 alternative responses, while three questions were designed to be answered using a modified visual analog scale (VAS). The left end on the scale was marked with “Yes, absolutely” and the right end with “No, not at all.” The respondents were free to make a mark anywhere along the scale. The scale was then divided into equal distances for analysis. Number zero represents the highest degree of agreement and number four represents the lowest degree of agreement with the statement. The questionnaires were tested for relevancy before distribution, by colleagues and patients not included in the cohort.

The questions asked about the following:

- Age
- Gender
- Health
- Smoking habits, former and current
- Number of teeth and implants
- Chewing ability
- Aesthetics
- Ability to clean teeth and implants
- Awareness of bleeding while performing oral hygiene
- Frequency of regular check-ups at dentists
- Presence of regular maintenance therapy

- Knowledge of complications
- Overall satisfaction, including costs and quality of life

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 (2013/790-31/2). The study followed the 'Strengthening the Reporting of Observational studies in Epidemiology' (STROBE) checklist.

Statistical analysis

The variables were entered into an Excel file. Quality control of the data file was performed and the data processed (descriptively and analytically) with a statistical package (SPSS 21.0, SPSS Inc., Chicago, IL). Student's *t*-test and chi square test were adopted in order to perform dropout analyses according to age and gender, respectively. Spearman's correlation coefficients were calculated to study the associations between ordinal data variables. Multiple ordinal regression analyses were used to analyze the influence of explanatory variables on the degree of satisfaction with the implant treatment and/or the degree of experience of problems with the implants after compensation for confounding variables. Results were considered statistically significant at $p < 0.05$.

Results

The final sample consisted of 400 individuals, 233 females and 167 males. The mean age of non-responders was 63.1 (standard deviation (SD) 14.4) years, and 66.3 (SD 13.7) years for responders. This difference was statistically significant ($p = 0.03$). The frequency of non-responders among males was 25.7%, while 20.1% of the females were non-responders. However, this difference was not statistically significant.

The investigated variables from the questionnaire are presented in Table 1 and Figures 2–11. The mean time elapsed since implant installation was 10 years (range 8–14). Six percent of the individuals reported that they were totally edentulous. The most common self-reported diseases were cardiovascular disease (17%) and diabetes (10%). Former smokers and smokers reported significantly more peri-implant problems ($p < 0.05$). A majority (61%) of the individuals visited dental hygienists at least once every year, and 34% at least twice every year (Table 1). Likewise, the majority (71%) of participants visited a dentist at least once a year.

The response frequencies for the questions in Figures 2–11 varied between 96.5% and 98.5% on every issue. A great majority experienced a high chewing comfort (Figure 2), and without any difference according to comfort between their teeth and implants. Seventy-three percent of the subjects were satisfied with the aesthetic appearance of the implant teeth without any significant differences according to gender (Figure 3). Most of the subjects found that they managed to clean their teeth, and they found the level of difficulty to clean teeth and implant constructions to be equal (Figure 4). Most subjects experienced the time required to clean their own teeth and their implant constructions to be the same (Figure 5). However, more individuals found it easier to clean

Table 1. Characteristics of potential explanatory variables to the degree of satisfaction with the implants.

Variable	Total sample (n = 400)
Time (yrs) since implant installation (mean (range))	10 (8–14)
Age (mean (range))	66 (29–94)
Sex	
Male (%)	42
Female (%)	58
Self-reported systemic disease	
Cardio-vascular disease (%)	17
Diabetes (%)	10
Cancer (%)	5
Immune disease (%)	1
Osteoporosis (%)	1
Smoking habits	
Never smoker (%)	34
Former smoker (%)	47
Smoker (%)	19
Self-reported number of implants (mean (range))	2.8 (1–12)
Self-reported number of teeth (mean (range))	17 (0–31)
Frequency of dental hygienist visits	
Not regularly (%)	34
Less than once every year (%)	5
Once every year (%)	27
At least twice every year (%)	34
Frequency of dentist visits	
Not regularly (%)	16
Less than once every year (%)	13
At least once every year (%)	71

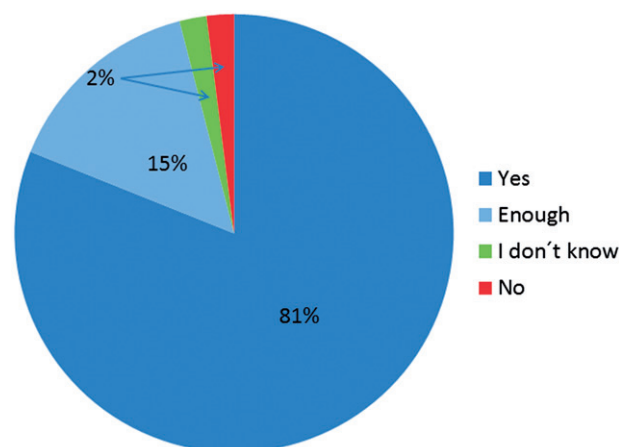


Figure 2. Statement: "I am comfortable chewing with my implants".

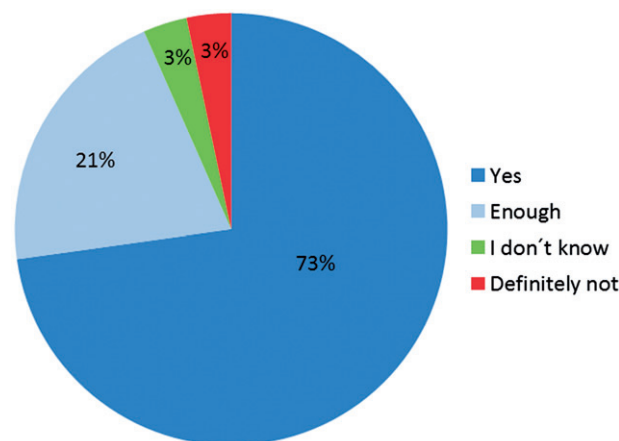


Figure 3. Statement: "I am pleased with the aesthetic result of the implants".

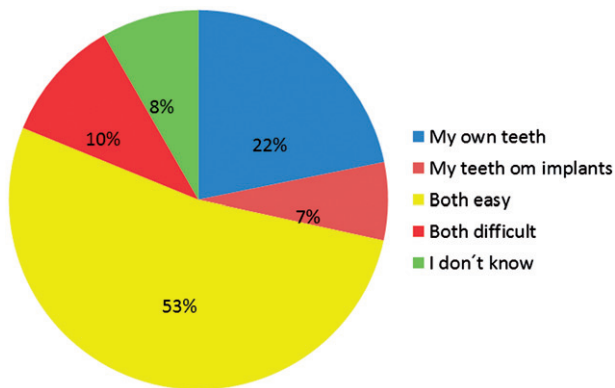


Figure 4. Statement: "It is easiest to clean".

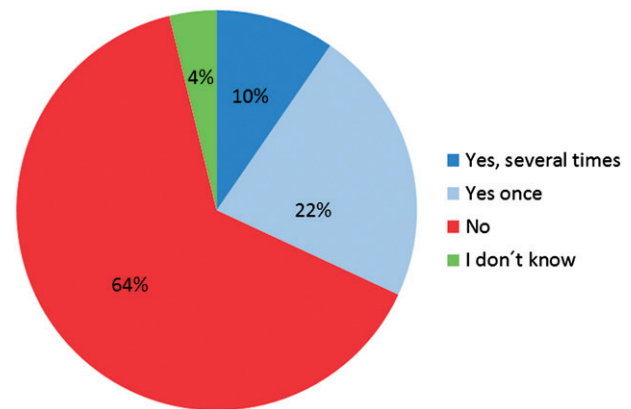


Figure 7. Statement: "I have experienced felt problems with my implants".

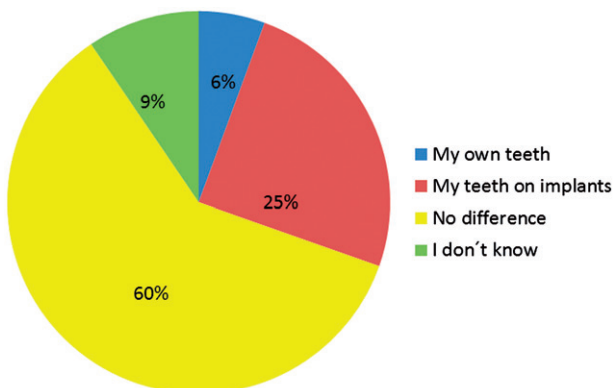


Figure 5. Statement: "It requires more time for me to clean".

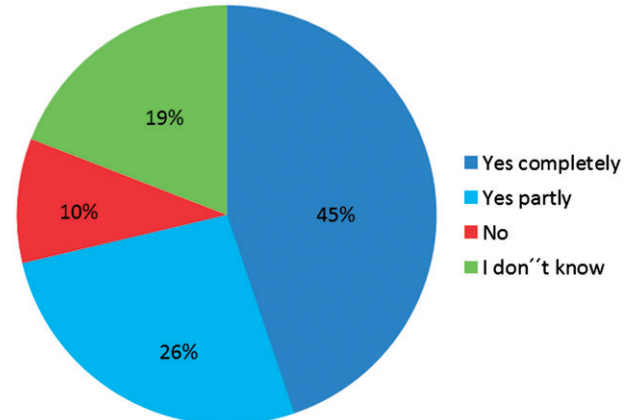


Figure 8. Question: "If you have had problems with your implant reconstructions, have these been satisfactorily resolved?"

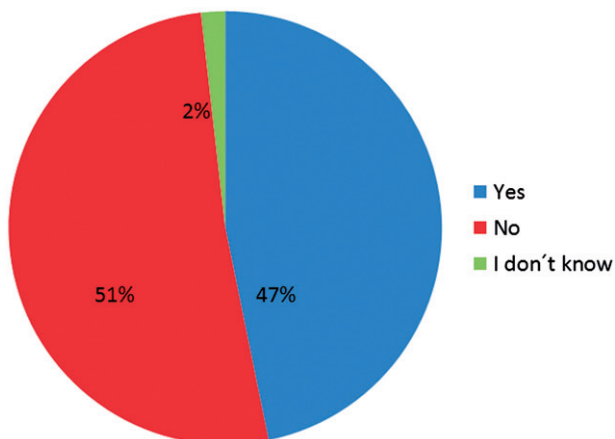


Figure 6. Question: "Have you noticed bleeding while cleaning your teeth?"

their own teeth than to clean the implant teeth. Among those subjects who noticed bleeding when they cleaned their teeth (47%, Figure 6), 39% found bleeding on their own teeth, and 11% found bleeding around the implant teeth. Thirty-two percent of the individuals experienced problems with their implant reconstructions (Figure 7), while in 23% of cases their dental hygienist or their dentist had informed them about implant complications. The result using the modified VAS to measure the degree of satisfaction with the implant treatment is illustrated in Figure 9. A great majority expressed a high degree of satisfaction with the treatment, and the median value was 0.5. A majority of the individuals

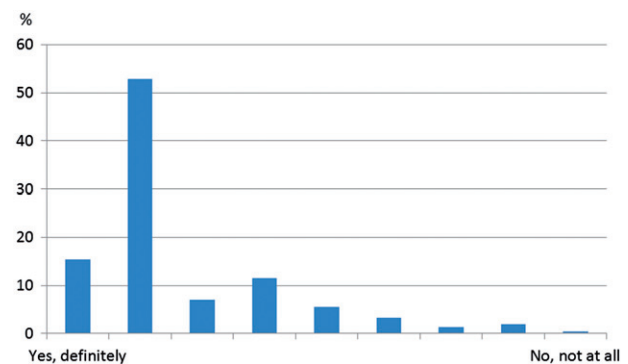


Figure 9. Statement: "I am satisfied with my implant treatment".

also found that their quality of life had increased after implant treatment (median 0.5, Figure 10), and a majority of them would to undergo the treatment again if needed (median 0.5). Most of the subjects would recommend implant treatment to their friends (median 0.5). However, when the individuals were asked to indicate on the modified VAS whether they found the cost of the implant treatment reasonable, more subjects plotted their answers nearer to "no" than to "yes" (median 2.5, Figure 11).

The correlations between the variables with ordinal data are illustrated in Table 2, and a high degree of multicollinearity exists between these variables. The magnitude of satisfaction with the implants was significantly higher ($p < 0.01$) for

those who felt no problems with the implants and in cases where problems with implants had been satisfactorily resolved (Figure 12). The degree of satisfaction with implant treatment did not differ depending on frequency of visits to dentist or dental hygienist. Females and individuals who noticed bleeding while cleaning their teeth more frequently felt problems with their implants (Figure 12). In addition, dentist visits and dental hygienist visits were significantly more frequent ($p < 0.05$) if the dentist had informed the patient about problems with the implants. A significant and positive correlation ($p < 0.001$) was found between the patients' experience of implant problems and complications with the implants according to their dentist or dental hygienist.

Discussion

This study was conducted on a group of patients who had received dental implants 8–14 years earlier at the specialist clinic at Skanstull in Stockholm. Questionnaires were sent by post to 494 patients, and 400 had replied, a response rate of 81%. In two earlier questionnaire studies regarding

patient-related outcomes after implant treatment, response rates of 61% [29] and 81% [10] were found. A response rate of about 80% must be considered decent, since the survey was distributed by post.

Although there are a large number of studies on dental implants, very few of them address long-term patients' satisfaction, specifically. Usually the studies compare different treatments modalities or are focused on aesthetics. In addition, the number of participants has been few, with short follow-up time, making it difficult to draw general conclusions. When designing the present questionnaire, we started from a previous study published by Pjetursson to better be able to compare our results.[27] Unfortunately, this is not a standardized assessment method as McGrath proposed for reliability in studies of patient-reported outcome measures (PROMs).[30] Some questions were reformulated and others added regarding the frequency of maintenance care. These questions were tested on colleagues and on some patients who did not participate in the study to ensure that the questions could be understood and seen as adequate. The response frequencies varied between 96.5% and 98.5% on every issue. The fact that the vast majority answered all questions leads to the conclusion that the participants perceived the questions as relevant. However, a limitation of the present study is the lack of evaluation of the validity of the questionnaire. It should be remembered that the study only examined patient satisfaction at one single time, that is, 8–14 years post-treatment, and that the implant treatment was performed at a specialist clinic. In addition, the patients represent an inhomogeneous group regarding background variables such as age and number of implants. This implies a certain limitation when interpreting the results. Consequently, the confidence

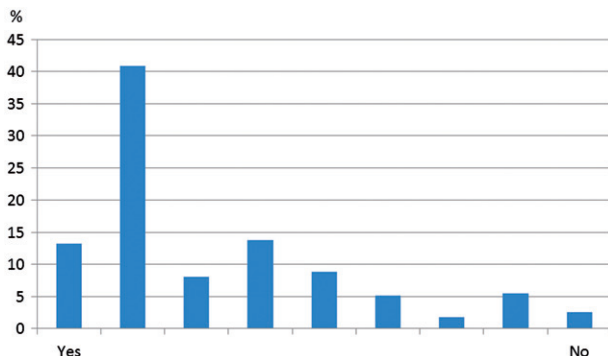


Figure 10. Statement: "My quality of life has increased after implant treatment".

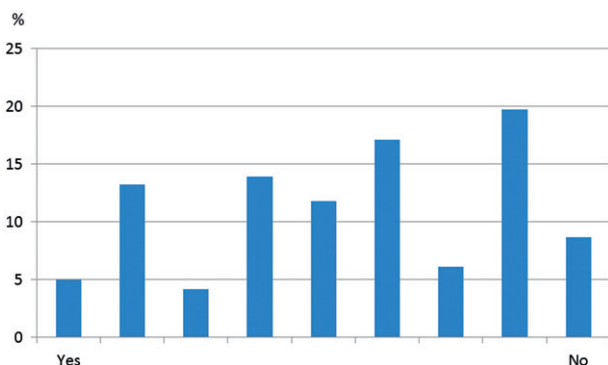


Figure 11. Statement: "I think the cost of the implant treatment was reasonable".

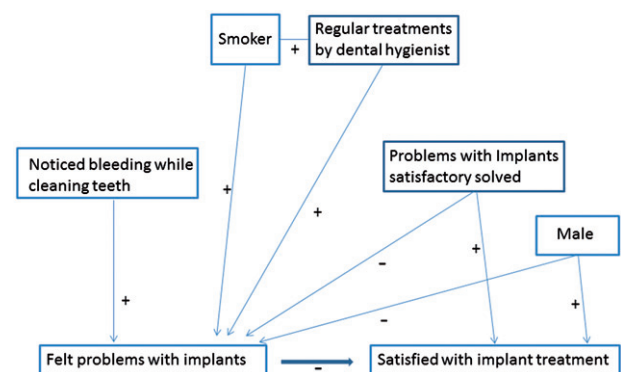


Figure 12. Chart describing the correlations between variables with significant influence on experience of problems with implants and/or the degree of satisfaction with implant treatment. "+" and "-" indicate positive and negative significant ($p < 0.05$) correlations, respectively.

Table 2. Correlation matrix for variables with ordinal data.

Variable	Satisfaction with implant treatment	Quality of life has increased	The cost of treatment was reasonable	I would do the treatment again if needed	I would recommend this treatment to my friends
Satisfaction with implant treatment	$r = 1.0$	$0.44 \, p < 0.001$	$0.25 \, p < 0.001$	$0.51 \, p < 0.001$	$0.59 \, p < 0.001$
Quality of life has increased	–	$r = 1.0$	$0.21 \, p < 0.001$	$0.35 \, p < 0.001$	$0.53 \, p < 0.001$
The cost of treatment was reasonable	–	–	$r = 1.0$	$0.15 \, p < 0.01$	$0.18 \, p < 0.001$
I would do the treatment again if needed	–	–	–	$r = 1.0$	$0.68 \, p < 0.001$
I would recommend this treatment to my friends	–	–	–	–	$r = 1.0$

Spearman's correlation coefficients are presented.

in the generalizability of the results can be influenced by bias and confounding factors affecting the external validity.

The aesthetic satisfaction with the implants is one of the most significant aspects of patient satisfaction. In this study, only 3% of the respondents were not satisfied with the aesthetic result. In total, 94% were satisfied or sufficiently satisfied with the aesthetics of their implant restorations. The responses in Figure 9 confirm this answer, since it is highly unlikely that general satisfaction would be so high if the patients were not satisfied with the aesthetic result. These represent the patients' subjective perceptions of the aesthetic result, and may not match the perception we have as professionals. It has been shown in a study that professionals may be more critical than patients respecting the aesthetics.[31] It is consistent with previous studies on aesthetic satisfaction in long-term follow-up.[10,11,27] There were no differences between genders regarding the aesthetic outcome. This is in contrast to results reported by Derks et al. [11] and Lam et al.[16] but in agreement with other studies.[10,32,33] In the present study, the overall satisfaction was higher among men, and this is partly in agreement with Balaguer, who found a statistically significant gender difference regarding the chewing function.[34]

A great majority (90%) considered that they were able to clean the implants adequately. The importance of good access for cleaning the implant reconstructions is crucial for avoiding complications. Twenty-five percent of the individuals reported spending more time cleaning the implant constructions than their own teeth. The answer is slightly different from the responses in the study by Pjetursson et al. in the sense that in our study twice as many considered that it took longer to clean the implant reconstructions.[27] This study includes single implants as well as full and partial fixed dentures, which may explain the difference in the responses.

The last five questions were statements about the existence of subjective and/or objective complications of implants. Nearly half of the patients (47%) had noticed bleeding when they were cleaning their teeth/implants. Since half of the participants did not know the source of the bleeding, or considered that teeth and implants bled equally often, we cannot draw any conclusion regarding the location of any inflammation. Incidence of mucositis on patient level is estimated at 30%.[22] In a study done by Buhlin et al. on the validity of self-reported periodontal health, gingivitis was significantly more common among those who answered "Yes" on the question if the gum was bleeding.[35] In this study, nearly 50% responded that bleeding occurred when they cleaned their teeth. The incidence of bleeding was therefore high. It may be that those who have obtained an advanced treatment, such as dental implants, are more aware and therefore more likely to report adverse events.

Complications are not uncommon after implant treatment. At the EAO Consensus Conference, it was concluded that over 33% of patients will experience some type of complication.[8] Thirty-one percent of the participants in the study by Derks reported experiencing complications with their implants.[11] In our material, 32% of the patients had experienced problems with the implant reconstructions, and one-third in this group reported multiple problems with their

implant reconstructions. One of 10 patients with complications stated that it was unfortunately not possible to resolve their problems, but nearly half of the participants' problems could be resolved to their complete satisfaction (45%), and 26% were partly resolved. As we expected in our hypothesis, patients who did not report any problems with their implant reconstructions were significantly more satisfied with the implant treatment. In addition, those patients with complications that could be resolved were more satisfied with the treatment. Respondents had visited a dental hygienist significantly more often if they had experienced problems with their dental implants and in those cases in which the dentist had informed the patients about problems with their implants. This indicates that problems with the implants motivated the patients to seek dental care, since technical and biological complications require interventions by the dentist and/or the dental hygienist.

Finally, five statements were presented and the participants were free to mark their answers on a VAS. The VAS was originally designed to evaluate pain, and the instrument is now used routinely in pain research.[36] Since this was a survey without interviews of the patients, we found it necessary to have some open-ended questions, but at the same time to have measurable responses consisting of ordinal variables. The VAS was used to give the participants more freedom in their responses compared to the other categorized questions. The most significant difference compared to previous studies was that many participants stated that they did not consider the cost of the implant treatment reasonable. However, the degree of satisfaction with the implants and the experience of increased quality of life after implant treatment were positively and significantly associated with the attitude that the cost of the treatment was reasonable. Although they perceived the cost as high, a significant number would recommend this type of treatment to their friends, and they would also undergo this type of treatment again if it were necessary. The study was conducted at a specialist clinic, which means that the results may be different compared to a general clinic. However, our results are in agreement with the results from the Department for Periodontology and Fixed Prosthodontics, University of Berne, Switzerland and a large study from Sweden, as well as from a study by the Department of Dentistry, Brazil, with patients from both public and private dental clinics as well as general practitioners and specialists.[11,27,33] Future studies allowing patient responses to be evaluated against objective clinical parameters by means of a clinical examination could provide answers to the reliability and validity of questionnaire studies as a part in implant studies.

In conclusion, a great majority of the patients expressed a high degree of satisfaction with their dental implant therapy 8–14 years after the treatment. Patients were less satisfied if they had experience of problems with their implant reconstructions and in cases when the clinicians were unable to resolve their complications.

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