

Patient-Centered Perspectives and Understanding of Peri-Implantitis

Angel Insua,* Alberto Monje,*† Hom-Lay Wang,* and Marita Inglehart*

Background: Patients undergoing dental treatment have an uncertain understanding about dental implant therapy and its complications. Therefore, the aims of this study assess the following: 1) level of knowledge, awareness, and attitudes about peri-implantitis; 2) information provided by dentists/specialists who perform the treatment; and 3) perceptions, level of satisfaction, and impact on patient quality of life (QoL).

Methods: Patients with implant restorative therapy currently undergoing peri-implant maintenance therapy were recruited. Participants completed an anonymous questionnaire that included general aspects of prognosis, including the following: 1) peri-implantitis; 2) etiology; 3) awareness; 4) attitudes; 5) treatment; 6) prevention; 7) risk factors; 8) quality of information; 9) level of patient satisfaction; and 10) QoL. Associations among questionnaire data were identified using univariate and multivariate analyses.

Results: Overall, 411 implants were included from 135 patients with implants. Frequency of peri-implantitis in the survey was 17.8% at the participant level, with 70% of them reporting high level of post-surgical satisfaction. Worry and concern were frequent findings among patients with peri-implantitis (64%), and 32% reported that living with the disease was terrible. The vast majority of patients (74.1%) did not have knowledge about peri-implant pathology. Patients with peri-implantitis showed statistically significantly better understanding of implant therapy ($P < 0.001$) and also higher average concern ($P = 0.004$).

Conclusions: Patients generally have a poor understanding and perception of peri-implantitis and its impact. QoL was impaired by the presence of peri-implantitis with high level of concern and low level of therapeutic satisfaction. Therefore, it is important to develop standardized information brochures to educate patients on risk factors and indicators of the disease to assist in the prevention of peri-implantitis. *J Periodontol* 2017;88:1153-1162.

KEY WORDS

Dental implants; patient education as topic; patient reported outcome measures; peri-implantitis; quality of life.

Research conducted in periodontics and implantology has always focused on clinical and radiographic parameters;¹ however, patient-related perceptions have recently gained interest.² As such, patient-reported outcome measures have become important criteria to assess overall treatment success.³

The concept of the oral health-related quality of life (OHRQoL) report is gaining popularity in the dental field.^{4,5} This is used to define how dental therapy influences an individual's QoL. More recently and due to increasing biologic and esthetic complications, some studies on quality of information, knowledge, and patients' awareness about dental implants have been conducted.^{6,7} The limited literature stresses that patients treated on a daily basis actually have little understanding about their pathologies, partly due to the scarcity of information.⁶ This fact may lead to patients' equivocal and unrealistic expectations, which can result in unpleasant surprises.⁷ With increased demand for dental implants for oral rehabilitation, the investigation and understanding of problems that arise are imperative to the development of standardized information guidelines to help provide patients who need implant therapy with a better understanding of treatment and possible future complications.

The frequency of peri-implantitis is $\leq 47\%$ at the patient level.⁸ Certainly, the lack of uniform definition of the disease misleads actual incidence, but it represents a major concern in implant dentistry.

* Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, Ann Arbor, MI.

† Department of Oral Surgery and Stomatology, ZMK Bern, School of Dental Medicine, University of Bern, Bern, Switzerland.

Additionally, a multitude of local and systemic conditions such as smoking, poor oral hygiene, or residual cement have qualified as risk factors/indicators for peri-implant diseases.⁹ Not surprisingly, patients with lost dentition due to periodontal disease are often exposed to higher susceptibility if habits are not modified prior to proceeding with dental implants.¹⁰ At any rate, even controlling such factors, peri-implant biologic complications might occur partly due to the presence of still unknown surgical and implant-related elements.¹¹ Furthermore, it is important to emphasize that peri-implantitis treatment outcomes remain uncertain and unpredictable.^{12,13} Hence, patient awareness about etiologic and contributing factors to this disease is essential to better inform individuals who opt to pursue implant treatment. Nevertheless, data in this regard are limited. Hence, the aims of this study are as follows: 1) to assess the level of knowledge, awareness, and attitudes about peri-implantitis in patients who have had dental implants; 2) to evaluate the quality of information provided by dentists/specialists who perform the treatment; and 3) to assess patients' perceptions, level of satisfaction, and impact of implant therapy on their QoL.

MATERIALS AND METHODS

This study protocol was determined to be exempt from approval by the Institutional Review Board for the Health and Behavioral Sciences, University of Michigan, Ann Arbor, Michigan (IRB #HUM00112527).

Study Population

Individuals (61 males and 74 females, aged 21 to 89 years; mean age: 61.8 years) provided with implant restorative therapy and undergoing implant maintenance at the Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, Ann Arbor, Michigan, between March 1, 2016 and August 31, 2016, were selected for the study. Inclusion criteria were as follows: 1) single or multiple implants placed and restored for >12 months; 2) individuals with/without regular periodontal and/or peri-implant maintenance; and 3) individuals with/without peri-implant pathology, such as retrograde peri-implantitis (radiolucency around implant apex secondary to endodontic lesion),¹⁴ mucositis, and peri-implantitis.

Data Collection

Information about sex, age, and treatment provider was registered, and location (anterior or posterior, maxilla or mandible), type of retention (fixed or removable), and type of treatment (implant-supported single crown, implant-supported/retained partial bridge, implant-supported/retained full maxilla and mandible, implant-supported/retained full-mouth rehabilitation) were noted. Rehabilitations involving canines were considered anterior, and if multiple

rehabilitations were observed, the patient was classified according to the most extensive one.

Questionnaire

Before undergoing implant maintenance, participants fulfilling the inclusion criteria were asked to complete an anonymous questionnaire (see supplementary Fig. 1 in online *Journal of Periodontology*). This included general aspects of prognosis, including the following: 1) peri-implantitis; 2) etiology; 3) awareness; 4) attitudes; 5) signs and symptoms; 6) treatment; 7) prevention; 8) risk factors; 9) quality of information; and 10) level of patient satisfaction. It was designed in agreement with all the authors, led by an expert (MI) in the field of patient-centered outcomes. To check its understandability, a first round was conducted with random implant patients (n = 15). Main concerns were noted, and the questionnaire was modified accordingly until perfect understanding of the questions was reached. This implant-based questionnaire consisted of multiple-choice questions and was delivered to patients during maintenance visits. As such, participants were provided with as many questionnaires as implants had been restored, in the event that different surgeons placed them.

OHRQoL was assessed with 15 items in a Likert Scale format, ranging from 1 = disagree strongly to 5 = agree strongly. Originally, these items were used as part of the Michigan Oral Health QoL Scale.^{4,5,15,16} To assess short- and long-term patient satisfaction, the post-surgical patient satisfaction questionnaire (PSPSQ) was also administered.^{5,17}

Methodology

One examiner (AI) screened records to detect candidates for participation in the present study conducted at the Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, Ann Arbor, Michigan. All patients agreed to participate in the present study before the questionnaire was administered by giving oral informed consent. All patients were informed using the following words: "We are measuring with this survey the knowledge and attitudes of the patients on implant therapeutic prognosis and peri-implant pathology. Peri-implant pathology might be considered [. . .] 'gum-disease-like' but around dental implants."

Case Definition of Peri-Implant Pathology

Included individuals had to apply a definition of peri-implantitis that was based on both clinical and radiographic measures in a cross-sectional basis. As proposed by Workgroup 4 of the Eighth European Workshop in Periodontology,⁹ "peri-implantitis is an inflammatory condition that is referred with a threshold of 2 mm of radiographic bone loss from

the implant–smooth interface.”⁹ All patients were retrospectively assessed to exclude any implant with an event of major early bone remodeling (≥ 2 mm). For this, a radiograph was either examined in the patient’s record or requested from the referral.

Statistical Analyses

Data were collected and expressed in mean values and frequency distributions. Additionally, correlations among different indicators were computed to explore the relationship present in the data. Descriptive statistics were conducted using software packages.^{†§} A knowledge index and treatment-related index were created by averaging answers of questions 26 to 33 and 34, respectively (see supplementary Fig. 1 in online *Journal of Periodontology*). Cronbach α coefficients were calculated for each index to determine reliability of indices.

RESULTS

Study Demographics

A total of 135 consecutive patients undergoing peri-implant maintenance therapy were recruited for the study and completed the survey (45.2% males and 54.8% females). Overall, 411 implants were assessed individually among the patients (Table 1). Most of these patients (109 of 135) were treated at the School of Dentistry, University of Michigan, Ann Arbor, Michigan; however, data from patients treated in private practice (34 patients) and in other dental schools (three patients) were also recorded. Furthermore, nine patients with implants from private practice and two from other dental schools received further implant treatment at the School of Dentistry, University of Michigan.

In general, 7.4% of patients had implants placed by a prosthodontist, 5.2% by a general dentist, 19.3% by an oral surgeon, and 66.7% by a periodontist. Moreover, 72.6% of patients presented with one to three implants, the group with only one implant being the largest (26.7%). Implants were placed from 1991 to 2016, with a mean of 4.62 years of follow-up. Overall, 56% of total study cases were single crowns, 39% were bridges, 3% were removable dentures, and the remaining 3% were fixed dentures. Posterior areas (79%) and maxilla (57.7%) were the most frequent location of implants. Only 7% of patients made their own decision to have an implant-supported restoration, whereas 17% of cases were recommended by dentists; in the majority of cases (76%), the decision was made by mutual agreement between the patient and dental care provider (Table 1).

Peri-Implant Pathology

Absence of complications during the follow-up period was reported in 84.4% of patients (Table 1). Among complications, implant failure was noted in 8.1% of

Table 1.

Overview of Respondents’ Implant-Related Treatment Experiences

Implant-Related Treatment Experiences	Frequency	Percentage
Number of implants		
One	36	27
Two	35	26
Three	27	20
Four	13	10
Five or six	15	11
Seven to 10	7	5
12 and 15	1 and 1	1
Decision to place implant was made by		
Patient	9	7
Dentist	23	17
Both	100	76
Implant was placed by		
General dentist	7	5
Periodontist	90	68
Prosthodontist	10	7
Oral surgeon	26	19
Used for		
Single crown	75	56
Partial bridge	52	39
Removable denture	4	3
Fixed denture	4	3
Location: front/back tooth	27/104	21/79
Placed in: maxilla/mandible	76/56	58/42
Frequency of implant follow-up		
Every 3 months	45	35
Every 6 months	42	32
Every 12 months	10	8
When I have time	8	6
Never	25	19
Complications: yes	21	16
Implant failure	11	8
Crown failure	3	2
Hex broken	1	1
Infection	1	1
Inflammation/denture	1	1
Other	4	3

The mean year in which the first implant was placed was 2012 (range: 1991 to 2016), with a mean follow-up time of 4.62 years.

cases and prosthetic complications in 4%. Frequency of peri-implantitis in the survey was 17.8% at the participant level and 9.97% at the implant level.

† SPSS Statistics v.22, IBM, Armonk, NY.

§ Excel 2013, Microsoft, Seattle, WA.

Post-Surgical Patient Satisfaction

Regarding PSPSQ, 67.9% of participants scored “5,” meaning that they would undergo implant surgery if they needed implant treatment again, and 20.1% reported “4.” Only 3.7% of participants answered “1” or “2” (mean index \pm SD = 4.51 ± 0.86). Furthermore, 64.9% of participants would be highly likely to recommend implant surgery to a friend (mean score, 4.50 ± 0.82) (89.5% in total for scores 4 and 5). Level of overall satisfaction (mean score, 4.55 ± 0.8) was reported at the maximum level by 69.4% of patients (Fig. 1A, Table 2).

Understanding and Perception of Peri-Implant Pathology

The vast majority of patients (74.1%) did not know what peri-implantitis was (supplementary Table 1 in online *Journal of Periodontology*), and 34.4% reported no or very little (16.8%) information provided by their dentist before initiation of implant treatment. Moreover, only 27% of surveyed individuals noted good or very good knowledge of peri-implant pathology (mean index \pm SD = 2.55 ± 1.43), and 51% reported no to very little knowledge (Fig. 1B). Thus, only 9.2% and 8% of patients received good information from their dentist about risk factors of peri-implantitis (mean index \pm SD = 2.11 ± 1.29) or frequency of disease (mean index \pm SD = 2.03 ± 1.26), respectively, whereas 66.2% and 68.4% presented with no and little knowledge, respectively.

Interestingly, 23.7% of patients did not know what causes peri-implantitis (Table 3). Additionally, 48.1% of them agreed that “bacteria cause peri-implantitis.” Half the number of patients (51.9%) were aware about interval follow-ups for correct implant maintenance. Of these, 19.1% of patients never complied with specific implant follow-ups after implant placement, and 34.4%, 32.1%, and 8% of them did follow-ups every 3, 6, and 12 months, respectively (Table 1).

One-third of surveys (31.1%) showed that patients did not know the success rate of peri-implantitis treatment. However, 32.6% of individuals believed that peri-implantitis treatments might achieve adequate/maintainable outcomes.

Gingivitis, smoking, diabetes mellitus, periodontitis, stress, bad oral hygiene, and titanium incompatibility were considered the most common co-risk factors for peri-implantitis in 80.0%, 74.1%, 63.7%, 94.1%, 42.2%, 86.7%, and 63% of individuals, respectively (see supplementary Table 2 in online *Journal of Periodontology*).

Affective Response and Behavioral Intentions to Peri-Implantitis Symptoms

The mean concern index (\pm SD) of individuals with peri-implantitis symptoms was 3.93 ± 1.17 (see supplementary Table 3 in online *Journal of Peri-*

odontology). Level of concern was lower with the presence of bleeding around the implant or gingival recession (GR) and implant neck exposition (mean index \pm SD = 3.53 ± 1.52) and higher with the presence of pain, pus, and mobility (mean index \pm SD = 4.16 ± 1.35 , 4.20 ± 1.39 , and 4.38 ± 1.28 , respectively).

Bleeding, GR, implant neck exposition, and food impaction were reported by individuals to require urgent treatment in 26%, 24%, 25%, and 25% of cases, whereas pain, infection, and mobility showed a higher demand of treatment (54%, 56%, and 55%, respectively) (see supplementary Table 4 in online *Journal of Periodontology*).

Patient Expectations

In total, 70.4% of patients agreed or strongly agreed that “implants are a life-lasting treatment” (Fig. 1C, Table 3), and another 62.9% of individuals surveyed showed agreement or strong agreement that “an implant can be rejected by the bone.” In addition, 61.4% thought fairly certainly that untreated peri-implantitis may ultimately cause implant loss.

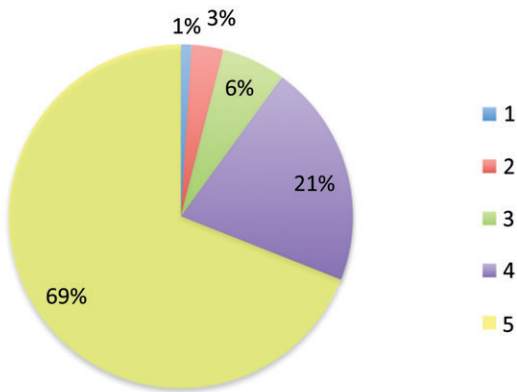
Strikingly, as a preferred treatment for peri-implantitis, 59% of patients chose to remove the diseased implant and place a new one after tissue healing (Fig. 1D). Furthermore, 6.7% of patients preferred only to remove the implant without placing a new one. The rest (20% and 12.6%) opted for guided bone regeneration and resective therapy to treat the disease, respectively.

Only 8% of patients reported that peri-implantitis impaired their life in all aspects, and only 12.5% of individuals had reduced general happiness due to their implant problems (70.8% of them showed strong disagreement with these statements).

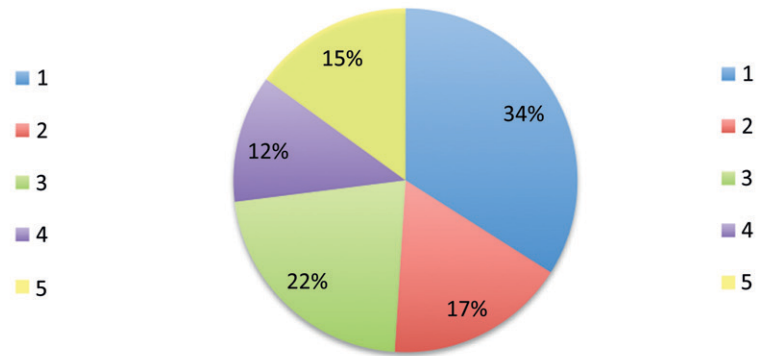
OHRQoL

In relation to OHRQoL (Table 4), 32% of individuals with peri-implantitis answered that they would feel “terrible” if they spent the rest of their lives with this problem (Fig. 1E). Another 28% felt “mostly dissatisfied,” and 24% reported “mixed feelings” (mean index \pm SD = 2.28 ± 1.17). Also, 16% reported that the disease was not really traumatic for them. Furthermore, 32% of individuals reported that peri-implantitis limited to some extent the kind and types of food that they can have (mean index \pm SD = 2.68 ± 1.35), but only 8% described a bad effect on the taste of food (mean index \pm SD = 1.64 ± 1.11). Another 48% of individuals suffered discomfort (mean index \pm SD = 3.20 ± 1.38) due to the disease. Worry and concern (Fig. 1F) were frequent findings among patients with peri-implantitis (64%; mean index \pm SD = 3.48 ± 1.30), but interestingly, peri-implantitis only limited the social life of 12% of individuals (1.76 ± 1.17). In addition, only 16% of patients with peri-implantitis expressed concern with eating (mean

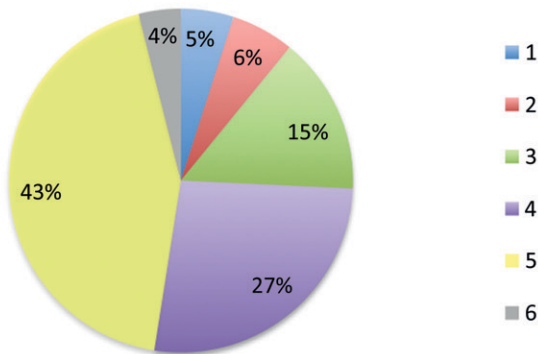
A Overall satisfaction with implants



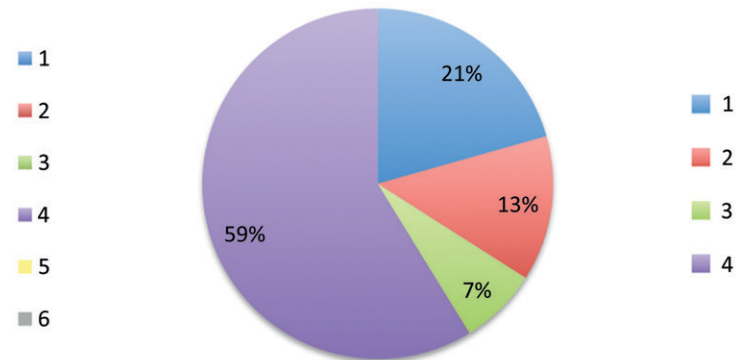
B Information about peri-implantitis



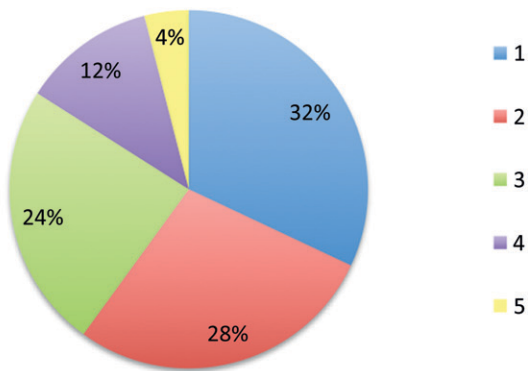
C Are implants life lasting?



D Peri-implantitis treatment preferences



E Living with peri-implantitis



F Worry and concern

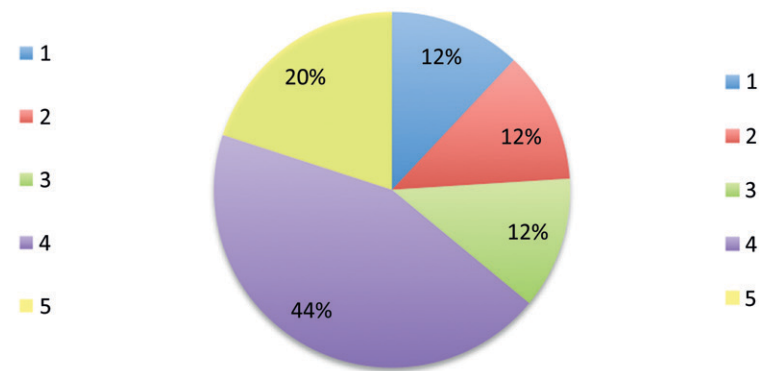


Figure 1.

A) Overall satisfaction with dental implants. **B)** How well did your dentist inform you about peri-implantitis? Answers for (A) and (B) ranged from 1 = not at all to 5 = very much/very well. **C)** Are dental implants a life-lasting treatment? Answers for (C) ranged from 1 = disagree strongly, 2 = disagree, 3 = neutral, 4 = agree, 5 = agree strongly, to 6 = I don't know. **D)** Treatment options for peri-implantitis: 1) save the implant by adding bone; 2) save the implant by removing gum or bone (more likely to last but worse esthetically); 3) remove implant; 4) remove implant and place more bone and a new implant after healing. **E)** If you [had to] spend the rest of your life with peri-implantitis, how would you feel about it? Answers for (E) ranged from 1 = terrible, 2 = mostly dissatisfied, 3 = mixed, 4 = mostly satisfied, to 5 = delighted. **F)** Peri-implantitis causes me a lot of worry and concern. Answers for (F) ranged from 1 = disagree strongly, 2 = disagree, 3 = neutral, 4 = agree, to 5 = agree strongly.

Table 2.
Treatment Satisfaction (Kiyak Satisfaction Scale)*

Satisfaction Items	1	2	3	4	5	Mean, SD
If you had to make the decision again, how likely would you be to have this surgery?	2 (2)	3 (2)	11 (8)	27 (20)	91 (68)	4.51, 0.856
How likely would you be to recommend dental implants to others?	2 (2)	2 (2)	10 (8)	33 (25)	87 (65)	4.50, 0.820
Overall, how satisfied are you with having implants?	1 (1)	4 (3)	8 (6)	28 (21)	93 (69)	4.55, 0.800
Overall satisfaction (Cronbach $\alpha = 0.873$)						4.52, 0.737; range = 1 to 5

Unless otherwise noted, data are reported as n (%).

* Answers ranged from 1 = not at all to 5 = very much.

index \pm SD = 2.04 ± 1.34) or speaking (mean index \pm SD = 1.88 ± 1.30) in front of other people. In this sense, 16% of individuals showed remarkable lower life enjoyment (mean index \pm SD = 2.16 ± 1.28), 12% significant limitation in their daily activities (mean index \pm SD = 1.76 ± 1.20), and 12% were affected in their intimate relationships (mean index \pm SD = 1.68 ± 1.15). General reduction of happiness in life was reported by 13% of individuals (mean index \pm SD = 1.96 ± 1.08), and the disease affected all aspects of a patient's life in 8% of cases (mean index \pm SD = 1.72 ± 1.06).

Multivariate Analysis

Patients knowing what peri-implantitis meant showed similar levels of average satisfaction and behavioral intention (Table 5). They further reported higher average concern than individuals who did not understand the meaning of peri-implantitis (mean index \pm SD = 4.38 ± 0.88 versus 3.80 ± 1.20 ; $P = 0.004$). These individuals expressed significantly higher level in the following items: 1) level of information about implants versus participants who ignored the concept of peri-implantitis (mean index \pm SD = 3.22 ± 1.35 versus 1.87 ± 0.97 ; $P < 0.001$); 2) score in the knowledge index (mean index \pm SD = 3.90 ± 0.69 versus 3.50 ± 0.56 ; $P = 0.02$); 3) score in the treatment-related knowledge index (mean index \pm SD = 4.01 ± 0.69 versus 3.40 ± 0.70 ; $P = 0.001$); 4) risk factors involved in peri-implantitis ($P = 0.02$); and 5) number of total correct answers ($P = 0.05$).

A lower level of satisfaction, but without statistical significance, was found in patients with peri-implantitis compared with healthy individuals (mean index \pm SD = 4.14 ± 1.18 versus 4.60 ± 0.58). Patients with peri-implantitis also reported non-significant higher average concern versus healthy individuals (mean index \pm SD = 4.23 ± 0.86 versus 3.85 ± 1.23). All other parameters analyzed showed similar non-

significant data, and the same happened with patients with and without implant complications. In these pools of patients, there was a marked drop in mean satisfaction level from 4.60 ± 0.61 for healthy patients to 4.11 ± 1.16 for those with implant complication.

Age, sex, and follow-up period did not show significant correlation to presence of peri-implantitis; average satisfaction, concern, or information but lower level of knowledge index was reported in older versus young participants ($r = -0.238$; $P = 0.05$) (see supplementary Table 5 in online *Journal of Periodontology*).

A negative weak but significant correlation was found between presence of peri-implantitis and year of implant placement ($r = -0.227$; $P = 0.01$) and recall time ($r = -0.134$; $P = 0.07$). Non-significant correlations were found between presence of peri-implantitis and sex ($P = 0.40$), age ($P = 0.20$), number of implants on each participant ($P = 0.32$), degree of the dentist ($P = 0.30$), and type of prosthesis ($P = 0.50$).

DISCUSSION

Principal Findings and Agreements/Disagreements With Previous Studies

Implant therapy is a common treatment modality nowadays for oral rehabilitation, but based on the present study findings, it seems that patients' understanding and awareness regarding any potential post-treatment complications and prognosis are generally low. As such, 74.1% of participants did not know the significance and implications of peri-implantitis on their treatment (see supplementary Table 1 in online *Journal of Periodontology*), a fact shown by the communication problems between the health provider and patients. This was further highlighted by a relatively high proportion of patients who reported no (34.4%) or very little (16.8%) information

Table 3.
Responses Related to Knowledge About Peri-Implantitis*

How Much Do You Disagree/Agree That	1	2	3	4	5	I don't know	Mean, SD
Implants are a life-lasting treatment	7 (5)	8 (6)	20 (15)	36 (27)	59 (44)	5 (4)	4.02, 1.161
Untreated peri-implantitis causes implant loss	5 (4)	13 (10)	14 (10)	23 (17)	60 (44)	19 (14)	4.04, 1.224
15% to 30% of patients with implants experience peri-implantitis	5 (4)	11 (8)	41 (30)	11 (8)	16 (12)	49 (36)	3.26, 1.099
I know what causes peri-implantitis	19 (14)	13 (10)	34 (25)	16 (12)	16 (12)	36 (27)	2.97, 1.320
Bacteria cause peri-implantitis	6 (4)	9 (7)	28 (21)	32 (24)	33 (24)	26 (19)	3.71, 1.152
An implant can be rejected by the bone	5 (4)	4 (3)	26 (19)	38 (28)	47 (35)	14 (10)	3.98, 1.061
I know which follow-ups and maintenance are needed for my implants to be healthy	3 (2)	13 (10)	26 (19)	34 (25)	36 (27)	21 (16)	3.78, 1.105
Peri-implantitis treatment is very successful	3 (2)	12 (9)	32 (24)	21 (16)	23 (17)	42 (31)	3.54, 1.109
Knowledge index (Cronbach α = 0.654)							3.63, 0.627; range = 2.00 to 5.00; n = 69
Peri-implantitis is treated with							
Non-surgical therapy (deep cleanings)	0 (0)	5 (4)	30 (22)	24 (18)	30 (22)	42 (31)	3.89, 0.947
Implant polishing	1 (1)	16 (12)	34 (25)	11 (8)	17 (13)	50 (37)	3.34, 1.073
Surface decontamination of the implant	1 (1)	10 (7)	34 (25)	17 (13)	18 (13)	49 (36)	3.51, 1.019
Implant removal (take the implant out)	2 (2)	6 (4)	36 (27)	19 (14)	21 (16)	46 (34)	3.61, 1.018
Bone regeneration (add bone around implant)	1 (1)	3 (2)	26 (19)	33 (24)	23 (17)	44 (33)	3.86, 0.897
Treatment-related knowledge index (Cronbach α = 0.835)							3.58, 0.764; range = 2.00 to 5.00; n = 61

Unless otherwise noted, data are reported as n (%).

* Answers were: 1 = disagree strongly, 2 = disagree, 3 = neutral, 4 = agree, and 5 = agree strongly.

related to the disease. On the other hand, only 14.5% of participants reported to have very good knowledge about peri-implantitis, in agreement with data reported by Yao et al.,¹⁸ who noted that 17.7% of patients had good information about implant therapy.

This lack of information may also reflect conflict of interest by the dentist toward certain treatment modalities. In other words, complete and detailed information about future complications of implant therapy can dramatically change patients' perception toward more conservative treatment, and therefore it may lead to a low acceptance rate of implant therapy. As previously investigated, miscommunication with patients before treatment might be the origin of misunderstandings and unrealistic expectations about the complexity and results of implant treatment.^{7,18} In the same way, increased concern was reported for patients with knowledge about peri-implantitis (most of them

after suffering the disease), also described by Abrahamsson et al.⁷ as increased anxiety level after disease diagnosis.

In this sense, patients from Hong Kong, China, showed high expectations for implant therapy to resolve any missing teeth and restore function, appearance, and QoL with low complexity and apparent high longevity.¹⁹ Additionally, underestimation of surgical skills needed for performing this treatment was observed.¹⁹ In agreement with such findings, 70.4% of participants in this study perceived that implants might be a life-lasting treatment (Table 3). Therefore, results are also partly in agreement with Atieh et al.,²⁰ who clearly demonstrated patients were misinformed about the likely occurrence of biologic complications. Similarly, only 51.9% of patients were aware of proper maintenance intervals (Table 3), and almost 20% of them never went for implant maintenance (Table 1), highlighting the false

Table 4.
OHRQoL Responses of 25 Patients Who Think They Have Peri-Implantitis (%)

	1	2	3	4	5	Mean (SD)
Peri-Implantitis*						
Limits the kinds or amounts of food I eat	28	16	24	24	8	2.68 (1.345)
Causes discomfort	16	16	20	28	20	3.20 (1.384)
Causes a lot of worry and concern	12	12	12	44	20	3.48 (1.295)
Keeps me from socializing/going out	60	20	8	8	4	1.76 (1.165)
Makes me uncomfortable when eating in front of others	52	16	16	8	8	2.04 (1.338)
Makes me uncomfortable when speaking in front of others	56	24	4	8	8	1.88 (1.301)
Makes me nervous	36	24	20	12	8	2.32 (1.314)
Makes me concerned about the way I look	46	25	8	13	8	2.13 (1.361)
Keeps me from enjoying life	40	28	16	8	8	2.16 (1.281)
Interferes with my daily activities	64	12	12	8	4	1.76 (1.200)
Interferes with my intimate relationships	64	20	4	8	4	1.68 (1.145)
Has a bad effect on the taste of food	68	12	12	4	4	1.64 (1.114)
Reduces my general happiness with life	4	25	17	13	0	1.96 (1.083)
Affects my life in all of its aspects	56	28	8	4	4	1.72 (1.061)
If you [had to] spend the rest of your life with peri-implantitis, how would you feel about it?†	32	28	24	12	4	2.28 (1.173)

* Answers ranged from 1 = strongly disagree to 5 = strongly agree.

† Answers were 1 = terrible, 2 = mostly dissatisfied, 3 = mixed, 4 = mostly satisfied, and 5 = delighted.

perception that dental implants are more resilient and require less care than natural teeth.^{18,21,22} Interestingly, although correlation between long-term implant function and patients' level of motivation and adherence to adequate maintenance have been reported previously,²³ the present study findings show that 66.9% of patients (percentage based on 130 of 135 responses) follow a 3- to 6-month recall schedule, whereas 19.1% of patients with implants have never gone to any implant follow-up after crown delivery (Table 1).

Despite this little understanding of implant therapy, PSPSQ showed a high level of patient satisfaction with treatment. Nearly nine out of 10 patients would have implant surgery again if needed, and 89.5% would recommend it to a friend (Table 2). As a matter of fact, 69.4% of participants scored a maximum level of satisfaction with the treatment. In accordance, Adler et al.²⁴ recently reported that the great majority of patients were highly satisfied with their implant treatment after 8 to 14 years. This study also showed that patients suffering with complications scored lower values of satisfaction. In the present study, 15.4% of patients self-reported complications (Table 1), lower than the 31% and 33% reported by Derks and Tomasi²⁵ and Albrektsson et al.,²⁶ respectively. Moreover, prevalence of peri-implantitis in the present study survey was 17.7% at the patient level and 9.97% at the implant level, similar to

14.5% of peri-implantitis reported recently in a large population study.¹⁰

Clinical Implications

This study shows important lack of knowledge among patients on implant therapy as a consequence of vague explanations provided by the dentist. Moreover, correlation between aged patients and lower level of knowledge related to dental implantology was found. In this sense, all dentists should thoroughly explain and select the best treatment options, which in many cases might not be implant-supported restorations. Furthermore, objective evidence-based peri-implantitis information about risk factors, prognosis, and complications together with a maintenance therapy program according to the patient's risk profile should be provided.^{21,27} This must be emphasized because an increase in the prevalence of peri-implant pathologies^{10,25} and a dramatic increase in dental implants being placed globally was observed. Along these lines, this study emphasizes the need for providing patients with adequate information to avoid future complications and legal issues. These complications are not only related to the dental field but are also psychologic. OHRQoL in this study sample (Table 4) showed that 64% of patients with peri-implantitis presented with high levels of concern related to implant disease. In most of them, anxiety

Table 5.**Mean Responses (SD) of Patients Who Had Versus Who Did Not Have Any Implant-Related Complications**

Indices	I Know What Peri-Implantitis Is		I Had Implant-Related Complications		I Have Peri-Implantitis	
	Yes, n = 33	No, n = 100	Yes, n = 21	No, n = 113	Yes, n = 24	No, n = 110
Average satisfaction	4.51 (0.804)	4.52 (0.721)	4.11 (1.161)	4.60 (0.607)	4.14 (1.175)	4.60 (0.577)
Average concern	4.38 (0.882)	3.80 (1.199); <i>P</i> = 0.004	4.10 (1.048)	3.89 (1.200)	4.23 (0.857)	3.85 (1.229)
Average information	3.22 (1.353)	1.87 (0.967); <i>P</i> < 0.001	2.22 (1.496)	2.20 (1.180)	2.18 (1.344)	2.21 (1.206)
Average behavioral intention	4.31 (0.655)	4.10 (0.607)	4.24 (0.584)	4.13 (0.627)	3.96 (0.680)	4.19 (0.604)
Knowledge index	3.90 (0.693)	3.50 (0.568); <i>P</i> = 0.02	3.69 (0.364)	3.61 (0.667)	3.64 (0.732)	3.62 (0.605)
Treatment-related knowledge	4.01 (0.693)	3.40 (0.699); <i>P</i> = 0.001	3.60 (0.959)	3.57 (0.725)	3.83 (0.825)	3.49 (0.098)
Sum of correct risk factors	2.79 (0.415)	2.42 (0.806); <i>P</i> = 0.02	2.43 (0.978)	2.51 (0.732)	2.63 (0.770)	2.49 (0.739)
Sum of all correct answers	5.27 (1.737)	5.19 (2.312); <i>P</i> = 0.05	5.43 (2.357)	5.14 (2.194)	3.04 (2.156)	2.64 (2.170)

was even higher due to the unexpected onset of disease in a therapy that 71% of patients believed was life-lasting. In this sense, 60% of patients felt “terrible” or “mostly dissatisfied” living with the disease. It was observed that most study participants with knowledge about peri-implant diseases have had peri-implantitis before; only 27.3% of patients with knowledge about the disease reported not having peri-implantitis.

Moreover, as reported by Yao et al.,¹⁸ the dentist or hygienist is the primary source of information about dental implants (42%), followed by friends or family members (25%) and the Internet (14%). This fact remarks on the importance of information that dentists provide patients, this being the only evidence-based source. Interestingly, available information on the Internet generally presents poor quality, and most patients have problems in understanding/interpreting it.^{6,28} It is worth noting that studies on adherence show that ≈30% to 60% of health information is forgotten within 1 hour, and therefore 50% of health recommendations are not strictly followed.²⁹ Therefore, incorporating psychosocial aspects of behavioral change, including counseling strategies, may elicit better patient outcomes.³⁰

Limitations and Recommendations for Future Research

Patients undergoing maintenance therapy at the School of Dentistry, University of Michigan, were screened and included in the present study. This may undoubtedly bias results because nearly 75% of patients were treated in a university setting, where oral health care is encouraged by residents and faculty from

an educational point of view. Hence, large populations with different socio-demographic characteristics could result in different findings; thus, results from the present investigation might not be extrapolated directly to other samples. Similarly, future inclusion of level of education in the survey could provide interesting data regarding correlation with access to specialist-level treatment and patients’ dental and implant knowledge.

CONCLUSIONS

Findings from the present study demonstrate the following: 1) patients’ understanding and perception of peri-implantitis and its prognosis is generally poor, and results reflect patients’ unrealistic expectations about implant dentistry and disappointment when informed about peri-implantitis; 2) patients’ QoL was impaired by the presence of peri-implantitis with higher levels of concern and lower levels of satisfaction with implant therapy; and 3) due to the relatively high number of complications occurring nowadays, including counseling strategies for possible risk factors associated with peri-implantitis as well as motivational programs for oral hygiene as part of the initial treatment phase is encouraged.

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Correspondence: Prof. Angel Insua, Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, 1011 North University Ave., Ann Arbor, MI 48109-1078. Fax: 734/936-0374; e-mail: ainsua@umich.edu.

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