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HUMAN RANDOMIZED CONTROLLED TRIAL

Comprehension and recall of information about factors associated with peri-implantitis: A randomized controlled trial

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Abstract

Background: To evaluate the effect of different communication strategies on comprehension and recall of information about factors associated to peri-implantitis.

Methods: A prospective, randomized controlled trial was conducted in consecutive patients diagnosed with peri-implantitis. The sample was divided into three groups according to the communication strategy used: Test group 1—Written communication via leaflet with visual aids (L-VA); Test group 2—Written communication via leaflet with no visual aids (L-NVA); and control group—only verbal communication with no leaflet (NL). A questionnaire assessing comprehension at baseline (T0) and recall at 3 months (T1) and 6 months (T2) was administered following the fuzzy trace theory with a combination of 11 "gist" and seven "verbatim" items. The "health belief model" dimensions were further examined to test the influence of the communication strategy upon perceived severity, susceptibility, benefits, barriers, self-efficacy, and behavioral intentions.

Results: Ninety-nine patients that fulfilled the eligibility criteria were included. Gist and verbatim comprehension of the control, risk factors, and preventive measures for peri-implantitis overall was significantly greater in the test groups, in particular in L-VA at T0 (n = 99). Nevertheless, recall was not influenced by the communication strategy at T1 (n = 85) or T2 (n = 78). No significant differences were noted between groups or as a function of time for any of the "health belief model" constructs with the sole exception of perceived barriers ($P = 0.045$), which proved lower in the test groups.

Conclusion: The comprehension of information about factors associated to peri-implantitis can be efficiently improved by using written communicative strategies, in particular when supplemented with visual aids. Nevertheless, this approach failed to show effectiveness in modulating recall or in changing behavioral intentions over follow-up (NCT04543604).

KEYWORDS
dental hygiene, implantology, periodontitis

1 | INTRODUCTION

The achievement of implant osseointegration is no longer a challenge for clinicians considering recent breakthroughs in material sciences and technical knowledge. Nevertheless, biological complications are currently an increasing concern, given their rising prevalence and the squeal they generate.[1] In fact, peri-implantitis—a biofilm-mediated inflammatory condition characterized by progressive loss of the supporting peri-implant alveolar bone[2]—is regarded as the leading threat to long-term implant stability.[3]

Emerging evidence points out that patients have a poor understanding and perception of peri-implantitis and its impact.[4–9] In fact, data from medical studies indicate that ≈70% of all patients tend to underestimate the treatment risks, while unrealistic positive expectations are observed in about 90% of all subjects.[10] This is in line with findings in the field of implant dentistry, where ≈70% of all patients expected implants to be a "life-lasting" treatment. Interestingly, ≈75% of the patients were reported to be unaware of peri-implantitis.[5] In effect, evidence has demonstrated that patients are misinformed about the likely occurrence of peri-implant disorders.[4] In this sense, it was shown that most patients have the false perception that implants are more resilient to complications than teeth, and hence require less care and support.[6] This circumstance is of clinical significance given that information regarding peri-implant diseases delivered before implant therapy is often deficient, resulting in an increased risk of complications.[7,11]

Communication strategies are therefore encouraged to enhance patient knowledge and understanding of potential events related to implant therapy, such as peri-implantitis.[5] Moreover, providing accurate information to patients when receiving dental implants is crucial to reduce false expectations, minimize problems concerning satisfaction, and induce behavioral changes where necessary.

The "health-belief model" is a theory-driven approach with the goal of inducing a behavioral change.[12] Accordingly, when a patient perceives a serious threat (e.g., the risk of developing a disease such as peri-implantitis) but is also given information about how to reduce this threat, it is likely that he or she will take action or change deleterious habits.[13] Other more recent theories applicable to behavioral change also incorporate the possibility of informed patient decision making, whereby key numerical information about benefits and harms is provided to patients (e.g., through a carefully designed information leaflet) with the purpose of helping them make an informed, risk-literate decision.[14–17] In particular, the "Skilled Decision Theory,"[18] based on the results of multiple international studies in different contexts, suggests that visual aids that make part-to-whole relations visually available and comparable, and hence focus on "transparent" risk and benefit communication, can be especially beneficial and cost-effective. However, it has not been determined whether such a brief, inexpensive and promising strategy can improve the comprehension of essential information related to peri-implantitis preventive measures and influence behavioral intentions. Thus, as recommended elsewhere,[5] the present study was performed to evaluate the effectiveness of different communication strategies (standard care verbal information versus written risk and benefit information versus written risk and benefit information plus visual aids) in enhancing comprehension referred to factors associated with peri-implantitis.

2 | MATERIALS AND METHODS

A three-arm, prospective randomized controlled study was conducted in accordance with the Declaration of Helsinki on human studies, following approval by the Ethics Committee of the University of Extremadura (Badajoz, Spain). The patients received and signed a written informed consent form. Patient data were anonymized.

The study was registered and approved by ClinicalTrials.gov (NCT04543604) and is reported according to the CONSORT statement.[19] The data that support the findings of this study are available from the corresponding author upon reasonable request.

2.1 | Study population

The patients were consecutively recruited at the CICOM Institute (Badajoz, Spain) from February 2018 to March 2020. The study was thus terminated in September 2020. Patients were eligible to participate if diagnosed with peri-implantitis. The initially considered case definition of peri-implantitis was based on that of Sanz and Chapple (soft tissue inflammation with increased probing depth, bleeding on probing, and peri-implant bone loss ≥2 mm).[20] However, shortly after the start of the study, the definition (soft tissue inflammation with increased probing depth, bleeding on probing, and peri-implant bone loss ≥3 mm) proposed by Workgroup 4 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions was released[21] and, following Ethics Committee approval, the protocol adopted this definition. Recruited patients that did not fulfill these criteria were excluded. Only patients with implants in function for at least 36 months were eligible. The severity of peri-implantitis was graded as slight: <25% of peri-implant vertical bone loss; moderate: ≥25% to 50% of peri-implant

vertical bone loss; or advanced: >50% of peri-implant vertical bone loss.[22] In the case of >1 implant with peri-implantitis in the same patient, the most severe grade of a given implant was assigned.

2.2 | Eligibility criteria

The following inclusion criteria were applied: partially or completely edentulous patients aged 18 to 80 years and rehabilitated with implant-supported, single-crown fixed prostheses or implant-supported overdentures; smokers or non-smokers; absence of infectious disease at the time of implant placement; and absence of systemic disorders or medications known to alter bone metabolism. Subjects were excluded if they were pregnant; presented uncontrolled medical conditions or diseases (e.g., diabetes mellitus with glycated hemoglobin [HbA1c] concentration >8%); or presented zygomatic or pterygoid implants. Patients with treated peri-implantitis/mucositis were likewise excluded.

2.3 | Study groups

Three groups were defined to test the hypothesis that the provision of key information about factors associated to peri-implantitis, and specifically in the form of visual aids, improves comprehension and recall of peri-implantitis and related indicators:

- Test group 1—Leaflet with visual aid (L-VA): Information concerning etiology, prevalence, risk indicators, and preventive measures referred to peri-implantitis was included (see supplementary Figure S1 in online Journal of Periodontology). Relevant scientific literature supported the statements. Pictograms were included to display the prevalence of disease with and without each indicator. The leaflet was provided by a dental hygienist immediately at the end of the appointment in a room outside the clinical area and once the diagnosis of peri-implantitis was confirmed. The leaflet was collected again ≈5 minutes afterwards.
- Test group 2—Leaflet with no visual aid (L-NVA): Information concerning etiology, prevalence, risk indicators, and preventive measures referred to peri-implantitis was included (see supplementary Figure S2 in online Journal of Periodontology). Relevant scientific literature supported the statements. No pictograms were included. The leaflet was provided by a dental hygienist immediately at the end of the appointment in a room outside the clinical area and once the diagnosis of peri-implantitis was confirmed. The leaflet was collected again ≈5 minutes afterwards.
- Control group—No leaflet (NL): only verbal information including all relevant aspects contained in the leaflets was provided to the patient by the principal investigator (AM) during the initial interview and once the diagnosis of peri-implantitis was confirmed. Delivery of the verbal information lasted ≈5 minutes.

The visual aids were in the form of icon arrays and were designed following recent evidence-based heuristic guidelines for the generation of transparent visual aids (see supplementary Figure S3 in online Journal of Periodontology).[23] Randomization was conducted after initial screening performed by a dental hygienist and before the initial interview with the principal investigator (AM). Patients were randomly assigned to the test or control groups according to the last digit of their chart number. Accordingly, patients with records ending in 1 to 3, 4 to 7, and 8 to 0 were included in test group 1, test group 2, and the control group, respectively. When the total required sample size of any of the groups was reached, patients were only recruited into the remaining groups to complete the total sample size.

2.4 | Questionnaire

The questionnaire was prepared in collaboration with experts in risk communication and risk-related behavior at the University of Granada (Granada, Spain). The classical "health-belief model"[24] was combined with more recent models based on "skilled decision theory"[18] focusing on informed patient decision making and the key role of knowledge and risk/benefit comprehension,[14–16] resulting in the conceptual model described in Figure 1. The questionnaires were provided and collected by a previously trained dental hygienist after the diagnosis was confirmed and the communication strategy was delivered (either test or control groups). The questionnaires were completed in a room outside the clinical area. Sufficient time was allowed for the patients to complete the questionnaire. Immediately afterwards, the data were transferred to an MS Excel file by a masked dental hygienist.

The questionnaires were administered at baseline (T0: at the end of the initial interview and once the patients assigned within the test groups declared to have read the leaflet) and at three (T1) and 6 months of follow-up (T2). The questionnaire included demographic data such as age, sex, marital status, occupation coded according to the CNO-11,[25] presence of systemic disorders, smoking, and number of implants. In addition, data concerning a history

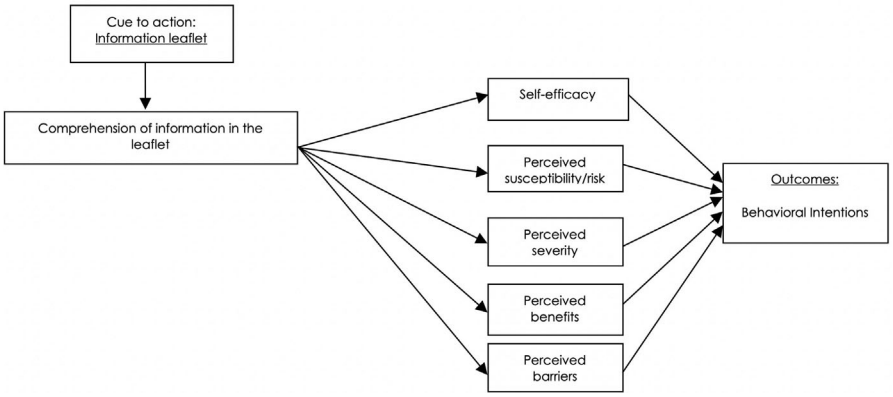

FIGURE 1 Conceptual model of the study

of periodontal disease and the type of prosthesis were documented and added to the demographic information.

The main outcome of interest was patient comprehension (at T0) and recall (the same questions at T1 and T2), which was assessed following the fuzzy trace theory[15] with a combination of 11 "gist" and seven "verbatim" items. "Gist" and "verbatim" items assess two different types of comprehension and recall, which may be helped by different interventions. In particular, "gist" items assess bottom-line meaning (i.e., that smoking increases the risk of peri-implantitis), whereas "verbatim" items target specific knowledge (e.g., of 100 people who smoke, how many would develop peri-implantitis?). "Gist" items inquired about patient expectations and knowledge referred to risk factors for peri-implantitis, including the influence of supportive peri-implant therapy, smoking, diabetes, periodontal disease, lack of keratinized mucosa or factors related to surgical or restorative aspects, among others. "Verbatim" items in turn referred to the likelihood of suffering peri-implantitis in patients with and without deleterious habits such as smoking or non-compliance with supportive therapy. The correct number of responses was calculated for each type of item individually and for all items combined. An English translation of all items and their scoring is available in Table S1 (in online Journal of Periodontology).

Secondary outcomes included the "health belief model" dimensions of perceived severity (two items), perceived susceptibility (two items), perceived benefits (two items), perceived barriers (two items), self-efficacy (two items), and behavioral intentions (four items). Internal consistency for each intended construct was evaluated for each timepoint, and total scores were derived by summing the responses of the respective items, provided that there was sufficient internal consistency. This was not the case for perceived barriers (Cronbach alphas alpha <0.4); the two items were therefore considered separately.

2.5 | Sample size

A priori sample size calculation was performed to power the study to detect a medium effect size (≈ 10% variance explained by the effect of group) on the patient comprehension/recall scores based on the effect of leaflets of this kind used in another context.[26] Using the *pwr* package[27] in the R statistical environment [28]to conduct an analysis of variance (ANOVA) assuming a significance level of alpha = 0.05, power = 0.80, three groups and an effect size of f = 0.33 (partial eta^2 = 0.10), a required sample size of 90 was established. We increased this size by 10% to compensate for any unforeseen losses, which resulted in a target sample size of 99 patients (33 per group). Initially, we planned an even larger sample in order to be able to detect even smaller effects (f = 0.25), but practical circumstances during the early stages of the trial (e.g., patient volume, change in case definition) caused us to settle for a final sample size of 99.

2.6 | Statistical analysis

Data were analyzed using the SPSS version 15.0 statistical package (SPSS Inc., SPSS for MS Windows, Chicago, IL, USA)[22] and R 3.5.1.[28] A descriptive analysis was performed to describe the data at the three timepoints, that is, baseline (T0) and at three (T1) and 6 months of follow-up (T2). Inferential analysis was conducted to analyze differences between the three groups referred to the primary and secondary outcomes. For this purpose, we applied the Brunner-Langer model for non-parametric data, considering each construct as independent outcome. An ANOVA-type statistic (ATS) was used to calculate changes over the study period and differences between groups. The homogeneity Chi^2 test was applied to assess the association between categorical variables, and the Kruskal–Wallis test was used to assess differences between groups on ordinal

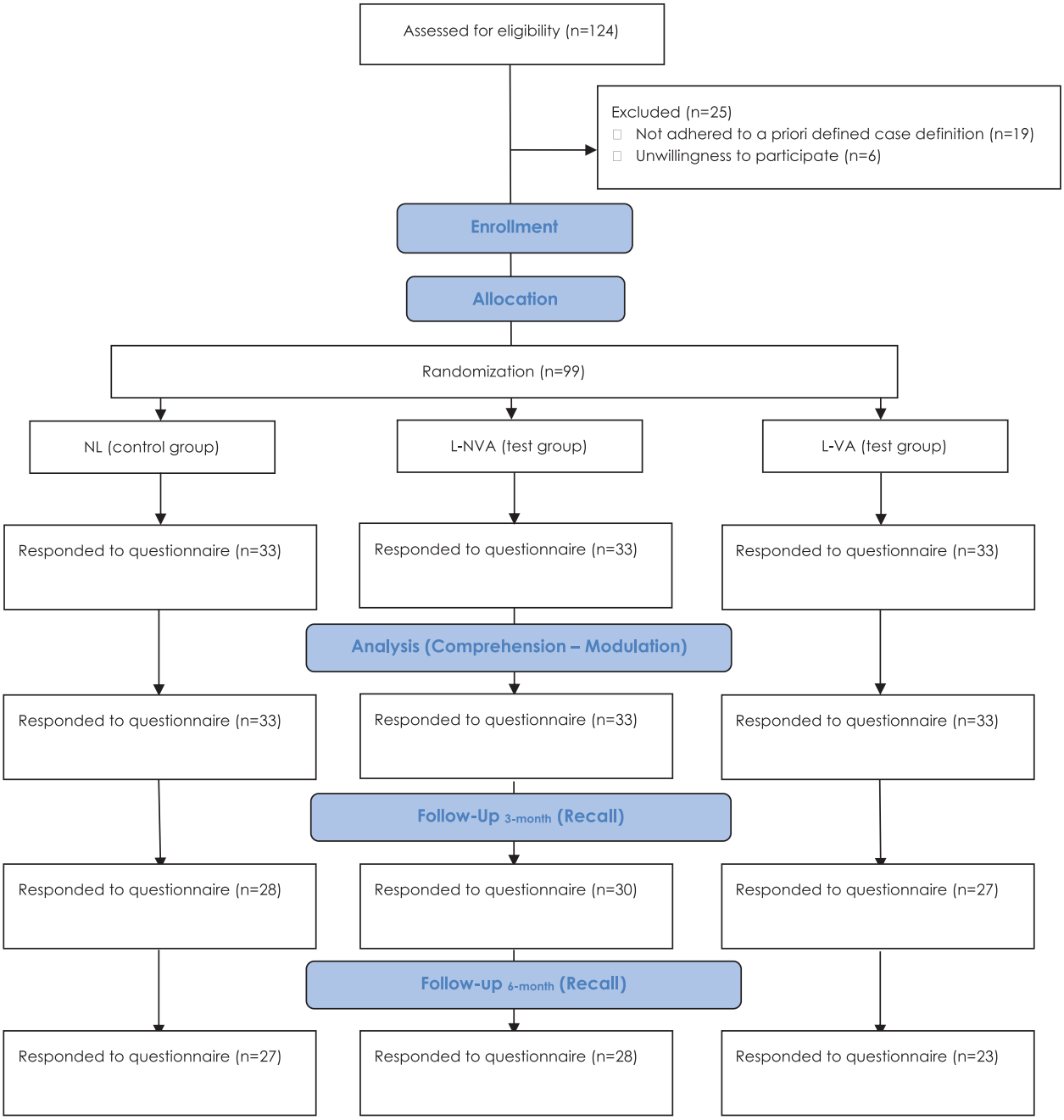

FIGURE 2 CONSORT statement workflow

variables. The significance level was set at 5% ($\alpha = 0.05$). The main analyses were done on the predefined constructs in the model (Fig. 1), and additional analyses were performed item-by-item to explore possible differences. Data from responders at each timepoint were analyzed.

3 | RESULTS

Ninety-nine consecutive patients diagnosed with peri-implantitis according to the currently accepted case definition[21] were recruited and equally distributed among the three study groups (Fig. 2). At T0, 99 patients agreed to participate. At T1 and T2, the sample dropped to 85 and 78, respectively.

3.1 | Demographic data

Females predominated over males (70.7% and 29.3%, respectively). The mean age was 55.6 ± 12.5 years. Of the included patients, 24.2% were coded two (technicians, intellectuals, and scientists) and 17.2% were coded three (technicians and professionals of support) according

to the CNO-11.[25] The median number of implants with peri-implantitis was four per patient (range = 1 to 16). The majority of the interviewed patients were married (59.6%). Former smokers represented 46.5% of the sample. Approximately two-thirds of the recruited sample had a history of periodontal disease. Overall, 23 patients were graded as having slight peri-implantitis (23.2%), 46 moderate peri-implantitis (46.5%), and 30 as advanced peri-implantitis (30.3%). The Chi^2 and Kruskal–Wallis tests evidenced homogeneity across the studied demographic variables.

3.2 | Interventions for the management of peri-implantitis during the study period

Surgical therapeutic modalities were the most frequent interventions for all three groups. In particular, the most frequent intervention in the control group (NL) was reconstructive treatment (36.3%), while for the L-VA and L-NVA groups the most common intervention was resective treatment with or without simultaneous soft tissue grafting (30.3% and 39.3%, respectively). The least frequent intervention for the NL and L-VA groups was implant removal (9% and 12.12%, respectively) and non-surgical therapy in the case of the L-NVA group (6%). Furthermore, 24.24%, 21.21%, and 9% of the patients in the L-VA, L-NVA, and NL groups, respectively, received no therapy due to patient unwillingness. There were no statistically significant differences between groups ($Chi^2 = 11.77$, $P = 0.300$).

3.3 | Comprehension (T0) and recall (T1 and T2) of the causes and prevalence of peri-implantitis

Considering all 18 items, the comprehension scores were modest at T0 (11.7 ± 3.7, median = 12). Likewise, as expected, comprehension was slightly worse when questions had to be answered based on long-term recall at timepoints T1 (10.2 ± 3.5, median = 11), and T2 (10.5 ± 3.6, median = 11).

Regarding "gist" comprehension, the ATS tests of the Brunner-Langer model revealed an effect of time ($P = 0.043$) that differed between groups ($P = 0.014$). In particular, as shown in Figure 3, the trajectories of the three groups differed significantly, mainly due to differences at T0. Specifically, "gist" comprehension at T0 was similar and higher for the L-VA (8.7 ± 2.4, median = 10) and L-NVA groups (8.7 ± 2.4, median = 9) compared with the NL group (8.3 ± 2.4, median = 9). However, these differences disappeared at T1 and T2 (see Fig. 3). Regarding the content of the specific questions, both types of leaflets

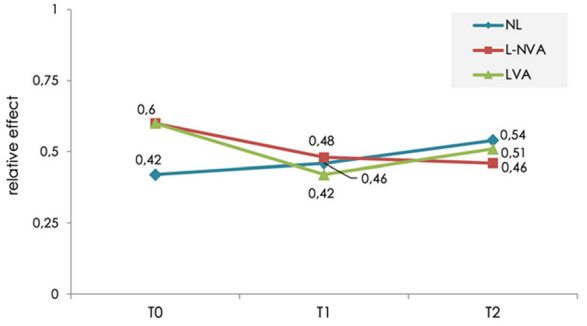

FIGURE 3 Relative effects for "gist" comprehension derived from the Brunner-Langer model, as a function of time and group. Note: A relative effect is the probability that the value of the score of a patient from a certain group at a certain time is greater than that of a patient randomly selected from the global sample

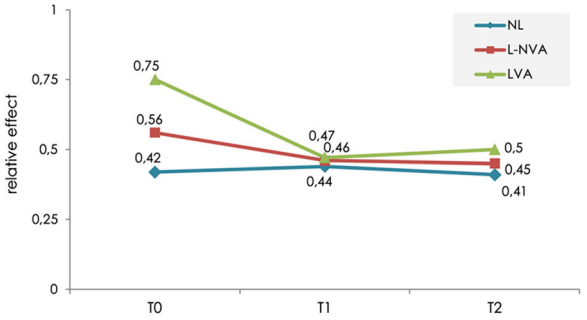

FIGURE 4 Relative effects for "verbatim" comprehension derived from the Brunner-Langer model, as a function of time and group. Note: A relative effect is the probability that the value of the score of a patient from a certain group at a certain time is greater than that of a patient randomly selected from the global sample

appeared to help patients recognize at T0 that smoking, diabetes, having a full arch prosthesis, and having implants inserted by professionals without training and experience were risk factors for peri-implantitis. However, as mentioned above, recall of these aspects at T1 and T2 tended to be poorer, and the mentioned advantage was not maintained over time.

Results regarding verbatim comprehension showed an effect of time ($P < 0.001$) and group ($P < 0.017$), and an interaction between time and group ($P = 0.010$). Figure 4 shows that similar in a way to "gist" comprehension, the effects on verbatim comprehension were concentrated at T0, with the L-VA group demonstrating highest comprehension (4.6 ± 1.7, median = 4), followed by the L-NVA group (3.4 ± 2.4, median = 3) and the NL group (2.3 ± 1.7, median = 2). However, the advantage of the leaflet groups disappeared over time (Fig. 4). In particular, the leaflet with visual aids (L-VA) was especially helpful for understanding the prevalence of peri-implantitis, the

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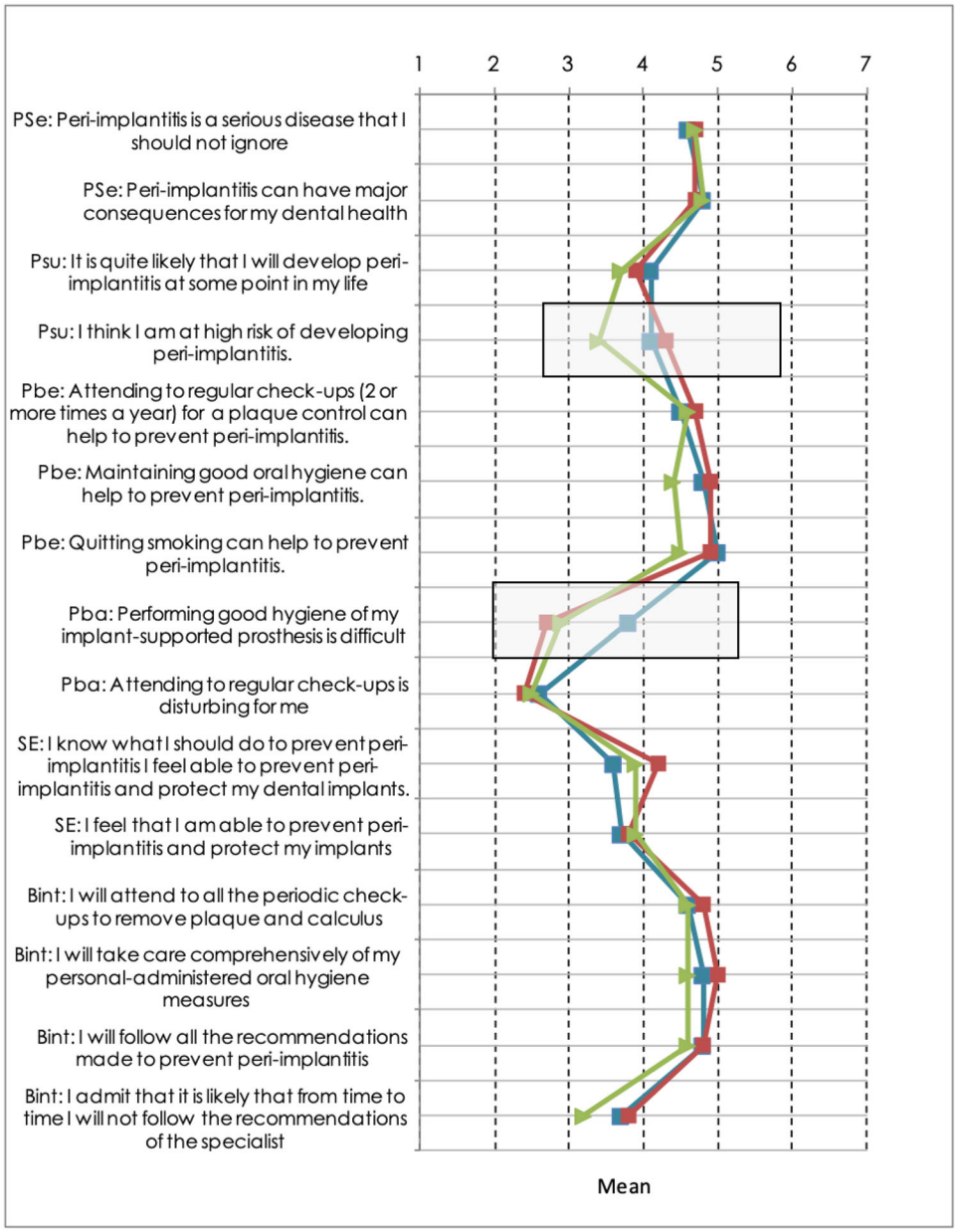

FIGURE 5 Mean ratings (0 = Strongly disagree to 7 = Strongly agree) of the Health Behavior Model items. Note statistically significant differences outlined in black boxes. PSe, perceived severity; Psu, perceived susceptibility; Pbe, perceived benefits; Pba, perceived barriers; SE, self-efficacy; Bint, behavioral intentions

magnitude of risk reduction achieved by regular plaque cleaning, and the amount of risk increase due to smoking. However, this advantage was not maintained over time. The results referred to the total comprehension score (a combination of "gist" and verbatim) followed a similar pattern.

3.4 | Health belief model dimensions

Overall, the patients tended to agree that peri-implantitis is a serious disease and that preventive behaviors (regular checkups, oral hygiene and smoking cessation) are beneficial, and they also reported positive behavioral intentions (e.g., to comply with all regular checkups). However, agreement with the items was not very high (about 5 out of 7 on average; see Fig. 5). In contrast, perceived susceptibility and self-efficacy were neutral on average (about 4 out of 7)—suggesting that many patients did not feel themselves to be at risk of peri-implantitis and also did not feel able to prevent it (Fig. 5). Perceived barriers were low to moderate (Fig. 5).

The ATS tests of the Brunner-Langer model did not reveal any significant differences between groups or as

a function of time in any of the model constructs—with one exception. There were between-group differences in one of the perceived barrier items ($P = 0.045$) that persisted over time, in particular, patients who had received a leaflet (L-VA and L-NVA) perceived that performing good hygiene of the implant-supported prosthesis is less difficult compared with patients who did not receive a leaflet (NL group) (see Fig. 5). The analyses of single items also revealed that patients in the L-VA group perceived that they were at lower risk of developing peri-implantitis (perceived susceptibility dimension) compared with the other groups ($P = 0.034$) (Fig. 5).

4 | DISCUSSION

Peri-implantitis is an undesired condition of great concern to clinicians, since it perturbs long-term implant survival. Measures aimed at preventing and minimizing recurrence after therapy, including changes in the patient risk profile and the promotion of beneficial health and hygiene habits, are pivotal for the control and prevention of peri-implant disorders. Therefore, communication with patients should be comprehensive to accurately inform and motivate them to adopt behaviors to effectively manage and prevent peri-implantitis.

4.1 | Principal findings

The "health-belief model" and "skilled decision theory" are psychological approaches with the goal of informing patients and inducing behavioral change.[12] For this purpose, a method based on stimuli/cues to action (in this case an information leaflet) is used so that patients may receive essential and clearly presented information and form perceptions of risk severity, benefits, barriers, self-efficacy, and preventive action intentions. Findings from the present study support the use of this approach, in particular when combined with visual aids, as this may lead to more thorough understanding of the factors associated to peri-implantitis. Nevertheless, the intervention proved to be inefficient in maintaining such improved comprehension over long-term recall among the patients at time-points T1 and T2. Studies within the medical field on patient adherence suggest that 40% to 80% of health information is forgotten within an hour.[29–32] In fact, recall of medical information is affected by the healthcare provider, the mode of information, and factors related to the patient, including education level. Therefore, based on findings from this study and despite the enhanced understanding recorded in the test groups, it is advisable for information pertinent to peri-implantitis to be reiterated over the course of supportive maintenance therapy.

4.2 | Agreements and disagreements with previous findings

With the increased concern about peri-implantitis, patient perspectives and perceptions of implant longevity and complications have been recently examined. Atieh et al. and Yao et al. highlighted the alarming proportion of patients with inaccurate perceptions and unrealistic expectations referred to implant therapy.[4,6] Interestingly, minimal awareness was noted of the need for peri-implant supportive therapy to maintain long-term health.[4] Insua et al. reported little patient knowledge about peri-implant disease. In fact, worry and concern were common findings among patients with peri-implantitis once they were aware of the presence of the disease.[5] Again, the limited understanding of the importance of supportive measures for preventing peri-implant disorders was underscored. In partial agreement with these publications, the present study found that ≈70% of the patients mistakenly thought that peri-implantitis is a rare disease and that implants are life-lasting devices. Brunello et al. found that only about 60% of all patients declared to have been informed about potential complications.

More encouraging data have been obtained concerning the number of patients (≈90%) who are aware of the fact that supportive peri-implant therapy helps prevent complications.[7] This is in agreement with data published elsewhere indicating that ≈60% of all patients received implant-related information primarily from dentists, and that ≈75% of the patients considered that their dentist provides the most useful information.[8] More recently, Pons et al. showed that the quality and quantity of information provided at the time of implant therapy, including the influence of confounders upon disease occurrence, was significantly associated to the diagnosis of peri-implant disease.[11] Hence, data from the aforementioned studies shed light on the inefficient communication strategies between clinicians and patients to date. Findings from the current study indicate that knowledge about peri-implantitis is generally poor, in particular in relation to patient expectations of implant therapy, the prevalence of peri-implantitis and the risk factors associated to the disorder. Moreover, it was seen that knowledge about peri-implantitis can be enhanced by means of psychological written communication tools, in particular when supplemented with visual aids. In fact, visual aids such as pictograms have been shown to effectively modulate patient adherence to a given therapy or recall program. For instance, data from medical sciences suggest that the use

of pictograms may have an impact in the form of an ≈70% adherence rate to recall when compared with spoken medical instructions only.[33]

4.3 | Psychological strategies to enhance comprehension and recall of information associated with peri-implantitis

Correct comprehension of risk and benefit-related information (e.g., how much does smoking increase my risk of developing peri-implantitis?) may be essential for the ability of patients to prevent or manage an illness, because it can influence perceptions, attitudes, and intentions conducive to positive behavioral change (e.g., smoking cessation). Previous studies from different contexts have shown that well-designed visual aids such as the icon arrays used in the current study can improve comprehension and recall of essential risk-related information, and can also influence health-promoting behavior.[23] In the current study, the leaflets improved the comprehension of multiple aspects related to peri-implantitis, but the added presence of visual aids resulted in even greater improvement. However, despite such improvement in comprehension, none of the interventions resulted in improved recall or more intentions to adopt preventive behaviors. In fact, patient intentions and perceptions regarding peri-implantitis and the associated actions often tended towards the mid-point of the questionnaire scale suggesting that there could be additional cognitions or perceived barriers that might be interfering. Future research should explore and address these barriers to more successfully increase patient motivation to prevent peri-implantitis. Nevertheless, the interventions had a sustained positive effect referred to perceived barriers; in this respect, performing good hygiene of the implant-supported prosthesis was perceived as being less difficult by the intervention groups, despite the fact that no instructions in this sense were given in the leaflets.

4.4 | Clinical implications

In light of the unrealistic expectations of patients regarding implant therapy[4–9] and the role played by local/systemic confounders and deleterious habits on the onset and progression of peri-implantitis,[2] it is crucial for patients to be aware of accurate information to cooperate effectively in preventing complications. Written communicative strategies using psychological models, including visual aids, therefore may be effective in dealing with modifiable factors and in increasing patient adherence to maintenance programs. These approaches have proven their effectiveness in the dental[34,35] and medical fields.[36,37] In this sense, it must be kept in mind that patients with peri-implantitis may use the internet as a source of information, and that online information has several shortcomings, including a low readability level due to the use of complex terminology, or inaccurate information.[38]

Of note is the fact that the findings from this study evidence the limited recall of information referred to factors associated with peri-implantitis over follow-up. Several aspects have been linked to recall capacity, such as age, anxiety, and distress.[39] The present study evidenced no associations between recall and any demographic variable. Thus, in light of the difficulties in remembering information related to peri-implantitis, it is advisable for clinicians and dental hygienists to reiterate instructions to promote peri-implant health and prevent complications during supportive maintenance therapy.

4.5 | Limitations

Caution is required when interpreting findings from this study, due to the following reasons: 1) The great majority of the included patients were referred with a presumptive diagnosis of peri-implantitis made by other clinicians, or the patients often manifested concerns about dental implants. This could bias the outcome given that patients might have received information from other sources. Hence, it would be convenient to test in the future whether the outcomes obtained are consistent in patients with healthy implants; 2) it must be kept in mind that recruitment took place in a private practice setting involving relatively well-educated Spanish patients willing to address the problem. Hence, findings from this study are not representative of other populations found in other environments and countries; 3) some risk factors/indicators (e.g., smoking or cement-retained prosthesis) cited in the leaflets as critical factors to prevent peri-implantitis have not been conclusively identified at the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions;[21] and 4) while verbal information was provided by the clinician (AM), leaflets were supplied by the dental hygienists. This methodological aspect could have favored the understanding and recall of patients enrolled in the control group given the authoritative role of the dentist in contrast to the hygienist. Nonetheless, this null hypothesis was not validated; moreover, 5) patient attrition from T0 to T2 may have biased the results, and the smaller sample size at T2 may have made it more difficult to evidence any differences between the groups.

5 | CONCLUSIONS

The comprehension of information about factors associated with peri-implantitis can be efficiently improved using written communicative strategies, in particular when supplemented with visual aids. Nevertheless, this approach failed to show effectiveness in modulating recall or in changing behavioral intentions over follow-up.

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The authors report no conflicts of interest related to this study.

AUTHOR CONTRIBUTIONS

Drs. Alberto Monje, Alva Perez, Andrés Catena, and Dafina Petrova designed the study protocol. Dr. Alberto Monje and Dr. Maria Vera-Rodriguez obtained the sample data and wrote the manuscript. Dr. José Nart participated in interpretation of the data and critically reviewed the study.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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