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RESEARCH ARTICLE

Evaluating the Knowledge of General Dentist Towards the Management of Peri-Implant Diseases: A Multi-Center, Cross-Sectional Study

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Abstract:

Background:

Recently, implants have been widely considered as an option for replacing missing teeth. There are several biological conditions that must be considered for the success of an implant. Failure to satisfy any of these factors may result in complications, such as peri-implantitis or failure of the implant.

Aim:

The aim of this study was to evaluate the general dentist's attitude towards the management of peri-implant diseases in Saudi Arabia.

Methods:

A multicenter cross-sectional electronic-based questionnaire was formulated based on the validated questionnaire from a previous study. It was targeted towards the general dental practitioners in Saudi Arabia. The study sample consisted of 721 general dental practitioners. The questionnaire consisted of 17 questions divided into five sections. Pearson's chi-square test was used for inferential statistical analysis with Holm's correction, for adjusted p-value, the alpha at 95% confidence interval was 0.05, and all values below alpha were considered statistically significant.

Results:

The majority of participants had attended an implant training course (51.2%) while the rest had not (48.7%). The majority of the participants (67.3%) thought they need special instruments for the detection of peri-implantitis but only 29.5% thought they do not need any special instruments for the intended purpose. Most participants (79.3%) said they can identify and differentiate between normal and abnormal soft tissue around an implant, while 6.5% of the respondents could not. More than half of the participants (54.8%) could differentiate between peri-implant mucositis and peri-implantitis, and 19.4% had no idea about this. Amoxicillin & metronidazole was considered as the best and most effective antibiotic by the majority of respondents (76%), while only (5%) of dentists selected ciprofloxacin.

Conclusion:

This study concludes by suggesting that most of the participants have adequate knowledge about peri-implant soft tissue assessment, mechanism of periodontitis and peri-implantitis, its initiation and progression along with its management. Most of the participants found the training courses on peri-implantitis to be efficient. It is recommended to conduct more courses and studies that would aim at understanding the pathogenesis, etiology, diagnosis, and treatment of peri-implant diseases so as to increase awareness among general dentists.

Keywords: Peri-implant mucositis, Peri-implantitis, General dentist, Titanium, Amoxicillin, Metronidazole.

1. INTRODUCTION

Recently, implants are being widely considered as an option for replacing missing teeth. There are several biological conditions that must be considered for the success of an implant. Failure to satisfy any of these factors may result in complications, such as peri-implantitis or failure of the implant [1].

Peri-implant diseases are inflammatory diseases of the surrounding implant tissues categorized into peri-implant mucositis and peri-implantitis. In peri-implantitis, the lesion

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presents progressive peri-implant bone loss beyond the initial physiologic bone remodeling that occurred following implant placement. In peri-implant mucositis, the lesion is limited to the peri-implant soft tissues and is diagnosed by the presence of bleeding on probing [2].

According to a study, the prevalence of peri-implantitis is one in four patients and of peri-implant mucositis is two in five patients. A recent meta-analysis on the epidemiology of peri-implant diseases conducted by Jepsen *et al.* during the 11th European workshop on periodontology shows the mean prevalence of 22% for peri-implantitis and 43% for peri-implant mucositis [2].

Radiographs also are helpful in appreciating the extent of peri-implantitis. Along with the absence of peri-implant radiolucency, a mean Marginal Bone Loss (MBL) ranging from 0.9 mm to 1.6 mm throughout the first postsurgical year was established as a benchmark for implant success. A mean annual MBL ranging from 0.05 to 0.13 mm at the maintenance phase was recognized as another criterion for implant success [3, 4]. There is also a lack of association between overload and peri-implant tissue loss in healthy conditions [5].

Management of peri-implantitis is done by the following methods, either individually or in combination. They include local debridement, surface decontamination of the implant, raising a surgical flap for cleaning and decontamination of the implant while trying to maintain and conserve the surrounding soft tissues and antimicrobial drugs. In case of retrograde peri-implantitis, treatment options like surgical debridement of the apical part of the implant with/without the application of a bone substitute/Guided Bone Regeneration (GBR) procedure and the possible resection of the apical part of the dental implant are advocated [6, 7].

It should be noted, however, that the local debridement of the implant should be done by instruments softer than titanium, such as: polishing paste with a rubber cup, interdental floss / brushes, or by using plastic scaling instruments [8].

There is very little available information regarding the attitude of a general dentist's towards the protocols used for the management of peri-implantitis. Therefore, the aim of this study was to evaluate the general dentist's attitude towards the management of per-implantitis diseases in Saudi Arabia.

2. MATERIALS AND METHODS

2.1. Study Design

A multicenter cross sectional electronic based questionnaire was formulated based on the validated questionnaire from a previous study [9]. It was targeted towards the general dental practitioners in Saudi Arabia. The questionnaire was circulated from 3rd April until 25th May 2020.

The questionnaire consisted of 17 questions in total which were divided into 5 sections. The first section was about the demographic data such as the patient's age, gender, education level and clinical experience. The second section consisted of questions regarding the implant therapy training, while the third section was about the soft tissue assessment for peri-implant. The fourth section dealt with peri-implant diseases. In

this section, questions were aimed at evaluating the general dentist's knowledge of the mechanism of periodontitis and peri-implantitis and about the progression of the disease. The fifth and the last parts of the questionnaire were regarding the treatment plan of peri-implant diseases.

2.2. Ethical approval

The ethical clearance for the study was obtained from the ethical committee of the College of Dentistry, Prince Sattam Bin Abdulaziz University in Alkharj province, Riyadh, Saudi Arabia (IRB/PSAU2020017). All the subjects of the study took part voluntarily, and their anonymity was ensured. All the data collected were treated confidentially.

2.3. Data Collection

The study sample consisted of 721 general dental practitioners in Saudi Arabia, which included both male and female dentists. The exclusion criteria included all consultants, specialists or undergraduate students. The survey was constructed using survey monkey and distributed to the doctors via emails and social media. Emails were also sent *via* the Saudi Commission For Health Specialities (SCFHS) to all the registered General Practitioner dentists (GP) in Saudi Arabia. The questionnaire was prepared in English with clear instructions explaining the nature and the objectives of the study. Before distributing the questionnaire, a pilot study was initially conducted on 5 randomly selected general dentists to evaluate the understanding of the questions, choices and also to calculate the time needed to complete the study. It was concluded that there were no issues encountered with the pilot study and the time taken was around 3-4 minutes.

2.4. Statistical Analysis

The collected data was analyzed using Statistical Package for Social Sciences (SPSS, IBM, v. 21). Frequency distribution of demographic variables and participant responses to individual questions were calculated. Pearson's chi-square test was used for inferential statistical analysis with Holm's correction for adjusted p-value; the alpha at 95% confidence interval was 0.05 and all values below alpha were considered statistically significant.

3. RESULTS

A total of 721 subjects participated in this study. Participants were almost equally distributed as males and females with slightly more males (51.3%) than females (48.4%), and most of the participants had 1-5 years of experience: (71.7%). Table **1** depicts the demographic information of participants. The majority of the participants were 24-30 years old (73.1%) and the least number of participants were above 40 years of age (7.6%).

Table **2** depicts the frequency distribution of participant's responses to individual questions. The majority had attended an implant training course (51.2%) while the rest had not (48.7%). Out of those who attended a training course, 26.1% said it was a short training course, 25.4% said it was provided by an academic organization, while the rest were trained by commercial courses or moderate training courses. Some of

them (38%) did not take any training courses. Most participants (51.2%) agreed on the optimal efficacy of the training courses on peri-implantitis while (13.9%) disagreed. Some of the participants (13.5%) did not have an opinion on this. The majority of the participants (67.3%) thought they needed special instruments for the detection of peri-implantitis, but only 29.5% thought they do not need any special instruments for the intended purpose. When asked about the instrument usually used for measurement of probing depth of peri-implantitis, most participants answered plastic probes (182, 25.2%), and the instrument least chosen was a titanium curette (3.7%). However, 37.2% of people thought the plastic curette was an ideal instrument for scaling the implant surface. Some of the participants (29.1%) had no idea about the ideal instrument for scaling and very few (4.6%) selected the stainless-steel curette.

Table 1. Demographic information of participants.

Demographics	Frequency (N=721)	Percentage (%)
Age		
24 – 30	527	73.1
31 – 40	137	19
>40	55	7.6
N/A	2	0.3
Gender		
Male	370	51.3
Female	349	48.4
N/A	2	0.3
Clinical Experience		
1-5 years	517	71.7
5-10 years	97	13.5
>10 years	63	8.7
>20 years	42	5.8
N/A	2	0.3

Table 2. Frequency distribution of participant responses to individual questions.

Questions	Frequency (N=721)	Percentage (%)
Have you attended any implant training course ?		
Yes	369	51.2
No	351	48.7
N/A	1	0.1
Training course provider:		
Short training course	188	26.1
Academic organization	183	25.4
Commercial courses	42	5.8
Moderate training course	34	4.7
N/A	274	38
Optimal efficacy of the training courses on peri-implantitis?		
Agree	369	51.2
Strongly agree	155	21.5
Disagree	100	13.9
N/A	97	13.5
Do you think you need special instrument for detection of peri-implantitis ?		
Yes	485	67.3
No	213	29.5
N/A	23	3.2
Which Instrument do you use for measuring (probing depth) instrumentation of peri-implantitis?		
Plastic probe–Implant cleaning brush	28	3.9
Plastic probe	182	25.2
Plastic probe- Stainless steel probe	102	14.1
Plastic probe –Titanium curette	87	12.1

(Table 2) contd.....

Questions	Frequency (N=721)	Percentage (%)
Plastic probe- Plastic curette	78	10.8
Stainless steel probe	171	23.7
Titanium curette	27	3.7
Plastic probe–Diluted hydrogen peroxide	15	2.1
N/A	31	4.3
What's the ideal instrument for instrumentation (scaling) the implant surface ?		
Plastic curette	268	37.2
No idea	210	29.1
Titaniumcurette	124	17.2
No curette	63	8.7
Stainless steel curette	33	4.6
N/A	23	3.2
Can you differentiate between normal and abnormal soft tissue around implant?		
Yes	572	79.3
No idea	83	11.5
No	47	6.5
N/A	19	2.6
Frequency of complications you have faced (failure/ inflammatory disease)?		
Lessthan 5 per year	508	70.5
5-10 per year	118	16.4
10-15 per year	34	4.7
N/A	61	8.5
Can you differentiate between peri-implant mucositis from peri-implantitis?		
Yes	395	54.8
No idea	140	19.4
No	164	22.7
N/A	22	3.1
Do you know the difference in initiating mechanisms of periodontitis and peri-implantitis?		
Yes	380	52.7
No	176	24.4
No idea	141	19.6
N/A	24	3.3
Do you know the difference in progression time of periodontitis and peri-implantitis?		
No	247	34.3
No idea	156	21.6
Yes	295	40.9
N/A	23	3.2
Peri-implantitis classification(s)		
Two	142	19.7
Three	387	53.7
One	51	7.1
Morethan three	106	14.7
N/A	35	4.9
Recall frequency for patients who received dental implants		
Every 1-6 months in the first year	321	44.5
Once a year	76	10.5
Every 1-2 months	55	7.6
Every 3-4 months	241	33.4
N/A	28	3.9
Which Antibiotic is most effective? (according to ADA)		
Amoxicillin- Metronidazole	548	76
Doxycycline	71	9.8
Azithromycin	43	6
Ciprofloxacin	36	5

(Table 2) contd.....

Questions	Frequency (N=721)	Percentage (%)
N/A	23	3.2

Most participants (79.3%) said they can identify and differentiate between normal and abnormal soft tissue around an implant, while 6.5% of the respondents could not. , The majority of the participants (70.5%), claimed to face complications such as failures and inflammatory diseases less than 5 times per year, while others (4.7%) said they face between 10 to 15 complications a year. More than half of the participants (54.8%) can differentiate between peri-implant mucositis and peri-implantitis, and 19.4% had no idea about this matter. Additionally, 52.7% knew the difference in the initiating mechanisms of periodontitis and peri-implantitis, while 19.6% had no idea. Furthermore, 40.9% of the participants knew the difference in progression time of periodontitis and peri-implantitis, but a significant number (34.3%) did not know this difference in progression. When asked about the classification(s) of peri-implantitis, the majority of the participants (53.7%) responded that there are 3 classes, and 7.1% said that there is only one class. The appropriate recall frequency for patients who received dental implants was thought to be every 1-6 months after the first year according to the majority of the participants (44.5%), every 1-2 months as per 7.6% of the participants and no recalls according to 3.9% of the participants. Amoxicillin-metronidazole was considered as the best and most effective antibiotic by the majority of respondents (76%), while only (5%) of dentists selected ciprofloxacin.

Table **3** presents the results of the chi-square test that was done to determine whether any significant difference existed in the knowledge of participants with respect to age, gender and clinical experience. Whether or not participants had attended a training course (Q.4) differed statistically significantly among different age groups (p=0.003), between males and females (p=0.014) and between different years of clinical experience (0.009). When participants did attend a training course, the training course provider (Q.5) differed significantly with respect to age (p=0.006) and clinical experience (p<0.001). The knowledge of instrumentation for measuring probing depth (Q.8) also differed significantly with respect to age (p<0.001) whereas the knowledge of instrumentation for scaling the implant site (Q.9) differed significantly with age and gender (p<0.001 for both). Similarly, knowledge of peri-implant classifications (Q.15) differed significantly with respect to age (p=0.013) and gender (p=0.007). Lastly, knowledge about progression time of periodontitis and peri-implantitis (Q.14) different significantly with respect to age only (p=0.045). There was no significant difference in responses to other questions with respect to any variable.

Table 3. Chi-square test comparing differences in responses of participants with respect to age, gender and clinical experience.

-	Question	Demographic Variable	p-value	Adjusted p-value
1	Have you attended any implant training course?	Age	<0.001	0.003
		Gender	<0.001	0.014
		Clinical Experience	<0.001	0.009
2	Training course provider: (if Q4 answer was yes, answer this question)	Age	<0.001	0.006
		Gender	0.305	1.000
		Clinical Experience	<0.001	<0.001
3	Optimal efficacy of the training courses on peri-implantitis?	Age	0.007	0.196
		Gender	0.713	1.000
		Clinical Experience	0.010	0.257
4	Do you think you need special instrument for detection of Peri-implantitis?	Age	0.040	0.876
		Gender	0.489	1.000
		Clinical Experience	0.146	1.000
5	Which Instrument do you use for measuring (probing depth) Instrumentation of peri-implantitis?	Age	<0.001	<0.001
		Gender	0.775	1.000
		Clinical Experience	<0.001	<0.001
6	What's the ideal instrument for instrumentation (scaling) the implant surface?	Age	<0.001	<0.001
		Gender	0.114	1.000
		Clinical Experience	<0.001	<0.001
7	Can you differentiate between normal and abnormal soft tissue around implant?	Age	0.116	1.000
		Gender	0.372	1.000
		Clinical Experience	0.131	1.000
8	frequency of complications you have faced (failure/ inflammatory disease)?	Age	0.060	1.000
		Gender	0.257	1.000
		Clinical Experience	0.014	0.340

(Table 3) contd.....

-	Question	Demographic Variable	p-value	Adjusted p-value
9	can you differentiate between peri-implant mucositis from peri-implantitis?	Age	0.073	1.000
		Gender	0.063	1.000
		Clinical Experience	0.142	1.000
10	Do you know the difference in initiating mechanisms of periodontitis and peri-implantitis?	Age	0.009	0.237
		Gender	0.595	1.000
		Clinical Experience	0.125	1.000
11	Do you know the difference in progression time of periodontitis and peri-implantitis?	Age	0.001	0.045
		Gender	0.140	1.000
		Clinical Experience	0.003	0.091
12	Peri-implantitis classification(s)	Age	<0.001	0.013
		Gender	0.149	1.000
		Clinical Experience	<0.001	0.007
13	Recall frequency for patients who received dental implants	Age	0.006	0.157
		Gender	0.795	1.000
		Clinical Experience	0.024	0.557
14	Which Antibiotic is most effective (According to ADA?)	Age	0.040	0.876
		Gender	0.003	0.091
		Clinical Experience	0.247	1.000

4. DISCUSSION

One topic of major interest in contemporary dentistry is the biological complications that are associated with dental implant therapy. These complications are usually inflammatory in nature coupled with bacterial challenges [10 - 12]. There are two clinical varieties that are commonly identified; peri-implant mucositis and peri-implantitis. Both diseases have an inflammatory lesion in the peri-implant mucosa, but the latter is characterized by progressive bone loss too [13]. Furthermore, many features are common between peri-implantitis and chronic adult periodontitis. This makes it important for dental implant practitioners to have knowledge about peri-implantitis in order to properly identify and manage these implant related complications.

This study population consisted of an almost similar proportion of male and female dentists which is similar to the study conducted by Tripathi *et al.*. Most of the participants included in this study had attended an implant training course (51.2%) and most of them had received this training either in an academic setting (25.4%) or from private course providers (26.1%). Only 21.5% of the participants strongly agree that the training provided was optimum, while the majority (51.2%) agree that the training was optimum. Studies have reported that a combination of clinical, didactic and simulation training is more effective in producing confidence and necessary skills among pre-doctoral students [14]. It is yet to be conclusively determined if the type of setting where training was received has any effect on knowledge. In our present study, the difference in knowledge was statistically significant among different training settings with respect to age, gender and clinical experience. In a similar study by Kadkhodazadeh *et al.* (2017) [9], majority of the participants had received dental implant training (97%) from an academic setting (61.8%) and agreed that they received optimum training (44.7%).

The majority of the participants in our study (67.3%), believed that a special instrument is required for probing in peri-implantitis, with the most participant's choosing a plastic probe (25.2%) followed by a stainless-steel probe (23.7%) and most (37.2%) believed that scaling of an implant surface must be carried out with a plastic curette. Prataptharajan and Suresh (2012) [6] recommend using a rigid plastic probe to measure probing death. It was earlier believed that stainless steel probes may further damage the already frail periodontal tissues in an infected implant site, but the Consensus Report of the Sixth European Workshop on Periodontology (Lindhe *et al.* 2016) [13] clarified that probing using a conventional stainless-steel probe with a light force of 0.25N does not damage either the mucosa or the implant. In addition, Farkhavar *et al.* (2012) [15] conducted an in-vitro study to test the effect of probes and scalers made of both metal and plastic on implant abutment surfaces. The study found that plastic probes produced surface roughness of the implant while metal probes did not. Other studies have shown that out of different oral hygiene instrumentations and methods like hand scaling with metal and plastic scalers, ultrasonic scaling with metal tips, weekly rubber cup polishing, air polishing, and daily brushing, rubber cup polishing with daily brushing produced the smoothest implant surfaces while plastic scalers performed better than metal scalers [16 - 18]. Some studies also recommend carbon fiber curettes and titanium curettes [7, 19, 20].

Most participants in our study could differentiate between a normal and abnormal tissue (79.3%), between peri-implant mucositis and peri-implantitis (54.8%), between the initiating mechanisms of peri-implantitis and periodontitis (52.7%), and between the progression times in periodontitis and peri-implantitis (40.9%). This displays that more than half of the participants can identify peri-implantitis from other similar infections. This is important as the first step in managing any disease is proper diagnosis. There are several parameters that are used to define the onset, extent and severity of peri-implantitis that help in its diagnosis. These include radiographic bone loss, probing depth, bleeding on probing, and suppuration. Mombilli *et al.* (2012) [21] defined the typical bone loss around implants to be a strictly demarcated, crater-like defect without any notable signs of implant mobility. Since

mobility denotes complete failure of the implant, the American Academy of Periodontology does not regard mobility as a diagnostic parameter and recommends the removal of the failed implant. There is no bone loss in peri-implant mucositis, which is the most distinguishing factor of peri-implantitis and peri-implant mucositis.

Lastly, there have been reports on the use of different kinds of antibiotics in conjunction with non-surgical and surgical mechanical debridement for the treatment of both chronic and aggressive periodontitis such as tetracyclines, doxycycline, penicillin (amoxicillin), metronidazole, macrolides (spiramycin, erythromycin, azithromycin), clindamycin and ciprofloxacin. A combination of amoxicillin and metronidazole is the most commonly reported combination therapy for the treatment of periodontitis [21, 22]. These aforementioned antibiotics have also been reported to be used for the management of peri-implantitis with the addition of ornidazole and azithromycin [23 - 26]. However, the significance of adjunctive antibiotic therapy in the treatment of peri-implantitis is controversial [24] and there is a lack of adequate research on the effectiveness and clinical advantages of the use of systemic antibiotics as part of the standard mode of peri-implantitis management [27, 28]. This precludes the need to conduct more randomized clinical trials to conclusively establish whether antibiotics help as adjunctive management strategies to clinical debridement. In our study, most participants (76%) chose the amoxicillin-metronidazole combination therapy as the most effective method to treat peri-implantitis, which is in line with reported literature [23, 24].

This study provides some important insights into the knowledge of dentists in Saudi Arabia regarding the management of peri-implant diseases. The surveyed participants seem to possess adequate knowledge in some questions and less than adequate knowledge in some other questions. To the best of the author's knowledge, this is the first multi-centre study done from the region involving a large sample and adds valuable information to literature that can be used by policy makers, course creators and academics teaching dental implant therapy in Saudi Arabia. As with all cross-sectional studies, response bias could be a limitation of this study.

CONCLUSION

This study concludes by suggesting that most of the participants have adequate knowledge about peri-implant soft tissue assessment, mechanism of periodontitis and peri-implantitis, its initiation and progression, along with its management. Most of the participants found the training courses on peri-implantitis to be efficient. It is recommended to conduct more courses and studies that would aim at understanding the pathogenesis, etiology, diagnosis, and treatment of peri-implant diseases so as to increase awareness among dentists.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethical clearance for the study was obtained from the ethical committee of the College of Dentistry, Prince Sattam

Bin Abdulaziz University Alkharj, with reference number (IRB/PSAU2020017).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in full accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the World Medical Association Declaration of Helsinki of 1975, as revised in 2008.

CONSENT FOR PUBLICATION

A written consent to publish this information was obtained from all the participants for publication of this study.

STANDARDS OF REPORTING

STROBE guidelines were followed in this study.

AVAILABILITY OF DATA AND MATERIALS

The data that supports the findings of this study are available at reasonable request to the corresponding author.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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