



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 8.4  
IJAR 2021; 7(2): 100-107  
[www.allresearchjournal.com](http://www.allresearchjournal.com)  
Received: 22-12-2020  
Accepted: 03-01-2021

**Rahaf Al-Safadi**

<sup>1)</sup> Department of Preventive Dentistry,  
College of Dentistry, Riyadh Elm University,  
Riyadh, Kingdom of Saudi Arabia  
<sup>2)</sup> University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Dalya Al-Anazi**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Abdulrahman Al-Hamidi**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Bandar Al-Khuraishi**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Basmah Al-Feraih**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Hayat Al-Aidroos**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Ruba Al-Mutlaq**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Alhanouf Al-Husseini**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Abdulaziz Al-Harbi**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Bayan Al-Kudhaibi**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Asma Al-Shehri**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Latifah Al-Saleh**

University Dental Hospital, College of  
Dentistry, Riyadh Elm University, Riyadh,  
Kingdom of Saudi Arabia

**Corresponding Author:**

**Rahaf Al-Safadi**

<sup>1)</sup> Department of Preventive Dentistry,  
College of Dentistry, Riyadh Elm  
University, Riyadh, Kingdom of Saudi  
Arabia

<sup>2)</sup> University Dental Hospital, College of  
Dentistry, Riyadh Elm University,  
Riyadh, Kingdom of Saudi Arabia

## Prevention and management of complications in implant dentistry among dentists in Saudi Arabia

**Rahaf Al-Safadi, Dalya Al-Anazi, Abdulrahman Al-Hamidi, Bandar Al-Khuraishi, Basmah Al-Feraih, Hayat Al-Aidroos, Ruba Al-Mutlaq, Alhanouf Al-Husseini, Abdulaziz Al-Harbi, Bayan Al-Kudhaibi, Asma Al-Shehri and Latifah Al-Saleh**

### Abstract

**Aim:** The aim of this study was to detect the knowledge and awareness of dentists practicing dental implantology in Saudi Arabia regarding the prevention and management of complications in implant dentistry.

**Materials and Methods:** 116 dentists practicing dental implantology in Saudi Arabia were randomly selected and asked to answer a systematized questionnaire about the dentist's demographic data, prevention, and management of complications in implant dentistry. The sample of the study consisted of dentists who hadn't received any specialty or training degree other than implantology and dentists who had received other specialty degree in addition to implantology. The validity and the reliability of the questionnaire were tested. The data obtained were tabulated, and the statistical parameter was estimated.

**Results:** Roughly half the periodontists and all the consultants in implant dentistry were aware of the three phases of technical errors in implant dentistry. A substantial number of the dentists believed that cardiovascular disease is not a risk factor to successful osseointegration and that diabetes mellitus is not an absolute risk factor to implant failure. Also, a substantial number of the dentists agreed that maxillary implants are more susceptible to smoking, thus implant failure. In addition, a substantial number of the dentists believed that age is not a risk factor to implant failure neither related to peri-implantitis and that if a 1 mm sinus penetration occurred during operation, the operation should be continued.

**Conclusion:** All dentists practicing implantology should dynamically get involved in all aspects of the prevention and management related to complications in implant dentistry. Also, workshops and symposia are recommended.

**Keywords:** Dentists, implant(s), management, prevention

### Introduction

The increased number of complications and errors in implant dentistry occurs due to many reasons such as the increased number of dentists of different specialties and experiences who are practicing implant dentistry <sup>[1]</sup>, the increased demand on dental implants <sup>[2]</sup> and the fact that many dentists are not competent or familiar with complications in implant dentistry because they have not received proper implant training through formal training programs which makes them lack the education, training, and experience that enable them to take the right decision and action to manage implant complications when they occur. Also, placing dental implants in compromised sites and patients. The idealism of implant cases presented in lectures to an audience of dentists may play a passive role in the increased incidence of implant complications <sup>[1]</sup>.

The aim of this study was to detect the knowledge and awareness of dentists practicing dental implantology in Saudi Arabia regarding the prevention and management of complications in implant dentistry.

## Materials and Methods

### Ethical approval

The study was registered with the research center of Riyadh Elm University (FRP/2019/190/56) and received ethical approval from the institutional review board of the same institution (FRP/2019/190/56/60).

### Selection of the content for analysis and statistical analysis

116 dentists practicing implant dentistry in the Kingdom of Saudi Arabia were randomly selected and asked to fill in a systematized questionnaire about the prevention and management of complications in implant dentistry. The study was carried out from January 2020 to March 2020. After taking the consent of the dentist on an informed consent statement form for clinical studies, each dentist was provided with a systematized questionnaire about prevention and the management of complications in implant dentistry which was adapted based on Togashi *et al.* [3] and Al-Safadi *et al.* [4] comprised of the following: The dentist's demographic data, prevention, and management of complications in implant dentistry (Figure 1). The sample of the study consisted of dentists who hadn't received any specialty or training degree other than implantology (general dentists, specialists, consultants) and dentists who had received other specialty degree, registered at the Saudi Commission for Health Specialties, in addition to implantology (specialists and consultants).

### Validation of the questionnaire

#### Content validity

The validity of the questionnaire was measured by testing the answers of experienced implantologists against the ideal answers. The experienced respondents were able to answer all questions correctly, suggesting that the questionnaire had valid clear content.

### Reliability

Reliability of the questionnaire was tested by distributing sixteen pilot sample questionnaires to dentists practicing implantology. The Cronbach's alpha was found to be 0.762 which is considered good for a new questionnaire according to Nunnally & Bernstein 1994 (pages 264-265) [5].

### Statistical analysis

After tabulation of the data obtained, the distribution and frequency of the different variables were described, and the statistical parameter was estimated (confidence intervals for proportions at confidence level 95%). All statistical analyses were performed using the IBM SPSS Statistics 20 data processing software.

### Results

The sample of 116 dentists practicing dental implantology in Saudi Arabia consisted (65.5%) males and (34.5) females. Also, the majority of the respondents received their education in implantodontics at universities (75.9%). In addition, the whole sample (100%) consisted of dentists who hadn't received any specialty or training degree other than implantology n=62 (53.4%) and dentists who had received other specialty degree in addition to implantology n=54 (46.6%) (Table 1). The dentists who hadn't received any specialty or training degree other than implantology were distributed as the following: general dentist's n=36 (31%), specialist's n=24 (20.7%) and consultant's n=2 (1.7%). However, the dentists who had received other specialty degree in addition to implantology consisted of specialists n=38 (32.7%) and consultants n=16 (13.8%), and they were distributed as the following: specialists in periodontics n=26 (22.4%), specialists in maxillofacial surgery n=10 (8.6%), specialists in prosthodontics n=2 (1.7%), consultants in periodontics n=8 (6.9%), consultants in maxillofacial surgery n=2 (1.7%), consultants in prosthodontics n=6 (5.2%).

<p><b>Title: Prevention and Management of Complications in Implant Dentistry among Dentists in Saudi Arabia</b></p> <p><b>Questionnaire</b></p> <p><b>Choose one correct answer</b></p> <p><b>Demographic Data</b></p> <p>1. Gender <input type="checkbox"/> Male <input type="checkbox"/> Female</p> <p>2. City -----</p> <p>3. Institution for specialization in implantodontics  <input type="checkbox"/> University <input type="checkbox"/> Academy/Institute  <input type="checkbox"/> Other clarify-----</p> <p>4. Institution for specialization in implantodontics  <input type="checkbox"/> Saudi Public <input type="checkbox"/> Saudi Private  <input type="checkbox"/> Non Saudi Public  <input type="checkbox"/> Non Saudi Private</p> <p>5. Clinical Practice Experience in dental Implantology  <input type="checkbox"/> ≤2 years <input type="checkbox"/> 3-5 years  <input type="checkbox"/> 6-10 years <input type="checkbox"/> ≥11 years</p> <p>6. Field of work  <input type="checkbox"/> General dentist <input type="checkbox"/> Specialist  <input type="checkbox"/> Consultant/ Professor</p> <p>7. Have you received other specialty degree registered at the Saudi Commission for Health Specialties?  <input type="checkbox"/> No <input type="checkbox"/> If <input type="checkbox"/> Yes, Check  <input type="checkbox"/> Periodontics <input type="checkbox"/> Maxillofacial surgery  <input type="checkbox"/> Prosthodontics  <input type="checkbox"/> Other clarify-----</p> <p>8. How many phases of technical errors are there in implant dentistry?  <input type="checkbox"/> One <input type="checkbox"/> Two <input type="checkbox"/> Three</p> <p>9. Cardiovascular disease is a risk factor for successful osseointegration.  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know</p>	<p>10. Diabetes Mellitus is an absolute predictor to implant failure.  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know</p> <p>11. Implants more susceptible to smoking, thus implant failure are...  <input type="checkbox"/> Maxillary <input type="checkbox"/> Mandibular  <input type="checkbox"/> I don't know</p> <p>12. Adjacent tooth roots are considered anatomic structures.  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know</p> <p>13. The bone thickness recommended between two implant platforms is...  <input type="checkbox"/> 1-2 mm <input type="checkbox"/> 2-3mm <input type="checkbox"/> I don't know</p> <p>14. The minimum vertical space from the implant platform to the opposing teeth/occlusal plane for crowns and bridges is....  <input type="checkbox"/> 5 mm <input type="checkbox"/> 10 mm <input type="checkbox"/> I don't know</p> <p>15. The minimum height from the implant platform to the opposing teeth/occlusal plane for an implant overdenture is.....  <input type="checkbox"/> 5 mm <input type="checkbox"/> 10 mm <input type="checkbox"/> I don't know</p> <p>16. The minimum safety space for placing an implant away from the nerve canal must be.....  <input type="checkbox"/> 1 mm <input type="checkbox"/> 2mm <input type="checkbox"/> I don't know</p> <p>17. Age is a risk factor contributing to implant failure.  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know</p> <p>18. Age is related to peri-implantitis  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know</p> <p>19. The most commonly affected during flap lifting is.....  <input type="checkbox"/> Mental nerve  <input type="checkbox"/> Mandibular alveolar nerve  <input type="checkbox"/> Lingual nerve  <input type="checkbox"/> I don't know</p>	<p>20. During operation, Schneiderian membrane tear (sinus penetration) of 1 mm occurred...  <input type="checkbox"/> Continue the operation and place the implant  <input type="checkbox"/> Abort the operation and unscrew or don't place the implant  <input type="checkbox"/> I don't know</p> <p>21. Implant positional failure occurs due to....  <input type="checkbox"/> Inappropriate treatment planning, only  <input type="checkbox"/> Poor surgical execution, only  <input type="checkbox"/> Inappropriate treatment planning and or poor surgical execution  <input type="checkbox"/> I don't know</p> <p>22. After implant insertion, a space &lt; 1 mm from the greatest diameter of the implant to the adjacent tooth was observed...  <input type="checkbox"/> Keep the implant  <input type="checkbox"/> Remove the implant  <input type="checkbox"/> I don't know</p> <p>23. A maxillary fully edentulous patient can only afford to pay four implants and prefers a long span conventional fixed bridge what would you recommend?  <input type="checkbox"/> Overdenture  <input type="checkbox"/> Long span conventional fixed bridge (1- or 2-unit cantilevers)  <input type="checkbox"/> Long span conventional fixed bridge (2- or 3-unit cantilevers)</p>
--	---	--

Fig 1: Questionnaire answered by the dentists randomly selected for this study

Roughly half the periodontists and all the consultants in implant dentistry were aware of the three phases of technical errors in implant dentistry. Also, a substantial number of the dentists believed that cardiovascular disease is not a risk factor to successful osseointegration and that diabetes mellitus is not an absolute risk factor to implant failure (Table 2). In addition, a substantial number of the dentists agreed that maxillary implants are more susceptible to smoking, thus implant failure and that tooth roots are anatomic structures. It was observed that almost all of the dentists believed that 2-3 mm is the bone thickness

recommended between two implant platforms (Table 3). A substantial number of the dentists agreed that 10 mm is the vertical space for implant overdenture, and almost all of them agreed that 2 mm is the safety space for placing an implant away from the nerve canal (Table 4). A substantial number of the dentists believed that age is not a risk factor to implant failure neither related to peri-implantitis, and a considerable number of them agreed that mental nerve is the most commonly affected during flap lifting (Table 5, Chart 1, Chart 2).

Table 1: Respondents' Profile (Demographic Data)

Question	Answer	Count	Percentage %
Q1 Gender	Male	76	65.5 [56-75]
	Female	40	34.5 [25-44]
Q2 City/Region	Middle Region (Riyadh)	84	72.4 [64-81]
	Western Region (Jeddah)	10	8.6 [3-14]
	Eastern Region (Al-Hofuf, Dammam, Dhahran, Al-Ahsa, Khobar)	15	12.9 [6-19]
	Northern Region (Hail)	3	2.5 [1-5]
	Southern Region (Abha)	4	3.4 [1-7]
Q3 Institution for Specialization in Implantodontics	University	88	75.9 [67-84]
	Academy/Institute	24	20.7 [13-29]
	Company	3	2.6 [1-6]
	Hospital	1	0.9 [1-3]
Q4 Institution for Specialization in Implantodontics	Saudi Public	16	13.8 [7-20]
	Saudi Private	60	51.7 [42-61]
	Non Saudi Public	18	15.5 [8-22]
	Non Saudi Private	22	19 [11-27]

Q5 Clinical Experience in dental Implantology	≤ 2 years	26	22.4 [14-30]
	3-5 years	60	51.7 [42-61]
	6-10 years	22	19 [11-27]
	≥11 years	8	6.9 [2-12]
Q6 Field of Work	General dentist	36	31 [22-40]
	Specialist	62	53.4 [52-71]
	Consultant/Professor	18	15.5 [8-22]
Q7 Other specialty degree registered at the Saudi Commission for Health Specialties in addition to dental implantology	No	62	53.4 [44-63]
	Yes, Periodontics	34	29.3 [20-38]
	Yes, Maxillofacial surgery	12	10.3 [4-16]
	Yes, Prosthodontics	8	6.9 [2-12]

A substantial number of the dentists believed that if a 1 mm sinus penetration occurred during operation, the operation should be continued (Chart 3). Almost all of the dentists believed that if the patient can only afford to pay four implants, an overdenture is the recommended implant prosthesis type. More than half the consultants in prosthodontics and all the consultants in maxillofacial

surgery and in implant dentistry participating in this study believed that a space < 1 mm from the greatest diameter of the implant to the adjacent tooth requires removal of the implant (Table 6). The majority of the dentists agreed that implant positional failure occurs due to inappropriate treatment planning and/or poor surgical execution (Table 7).

**Table 2: Questions 8-10**

Specialty		Responses-Estimated Proportions (95% CI)											
		Q8 Phases of technical errors in implant dentistry				Q9 Cardiovascular disease and successful osseointegration				Q10 Diabetes Mellitus and implant failure			
		One %	Two %	Three %	Total %	Yes %	No %	I don't know %	Total %	Yes %	No %	I don't know %	Total %
Implant*	GD*	0	88.9	11.1	100	16.7	55.6	27.8	100	11.1	77.8	11.1 [5-17]	100
	Specialist	16.7	[83-95]	[5-17]	100	33.3	[46-65]	[19-36]	100	[5-17]	[70-86]	0	100
	Consultant	0	66.7	16.7	100	50	66.7	0	100	16.7	83.3	0	100
Perio*	Specialist	15.4	30.8	53.8	100	38.5	53.8	7.7	100	38.5	61.5	0	100
	Consultant	0	50	50	100	50	50	[2-13]	100	50	50	0	100
		0	[40-60]	[40-60]	100	[40-60]	[40-60]	0	100	[40-60]	[40-60]	0	100
Surgery*	Specialist	0	100	0	100	40	60	0	100	20	80	0	100
	Consultant	0	100	0	100	100	0	0	100	100	0	0	100
Prostho*	Specialist	0	100	0	100	100	0	0	100	100	0	0	100
	Consultant	33.3	66.7	0	100	0	100	0	100	0	100	0	100

\*Implant = Implantology, Perio = Periodontics, Surgery = Maxillofacial Surgery, Prostho = Prosthodontics, GD = General Dentist

**Table 3: Questions 11-13**

Specialty		Responses-Estimated Proportions (95% CI)											
		Q11 Implants more susceptible to smoking				Q12 Adjacent tooth roots				Q13 Bone thickness between two implants			
		Maxillary %	Mandibular %	I don't know %	Total%	Yes %	No %	I don't know %	Total%	1-2 mm %	2-3 mm %	I don't know %	Total%
Implant*	GD*	77.8	16.7	5.6	100	50	44.4	5.6	100	11.1	88.9	0	100
	Specialist	[70-86]	[9-24]	[1-10]	100	[40-60]	[35-54]	[1-10]	100	[5-17]	[83-95]	0	100
	Consultant	41.7	16.7	41.7	100	58.3	41.7	0	100	0	100	0	100
Perio*	Specialist	100	0	0	100	100	0	0	100	0	100	0	100
	Consultant	76.9	15.4	7.7	100	69.2	23.1	7.7	100	7.7	92.3	0	100
		[69-85]	[8-22]	[2-13]	100	[74-90]	[10-26]	[2-13]	100	[2-13]	[87-97]	0	100
Surgery*	Specialist	40	60	0	100	100	0	0	100	0	100	0	100
	Consultant	100	0	0	100	100	0	0	100	0	100	0	100
Prostho*	Specialist	100	0	0	100	100	0	0	100	0	100	0	100
	Consultant	100	0	0	100	66.7	33.3	0	100	0	100	0	100

\*Implant = Implantology, Perio = Periodontics, Surgery = Maxillofacial Surgery, Prostho = Prosthodontics, GD = General Dentist

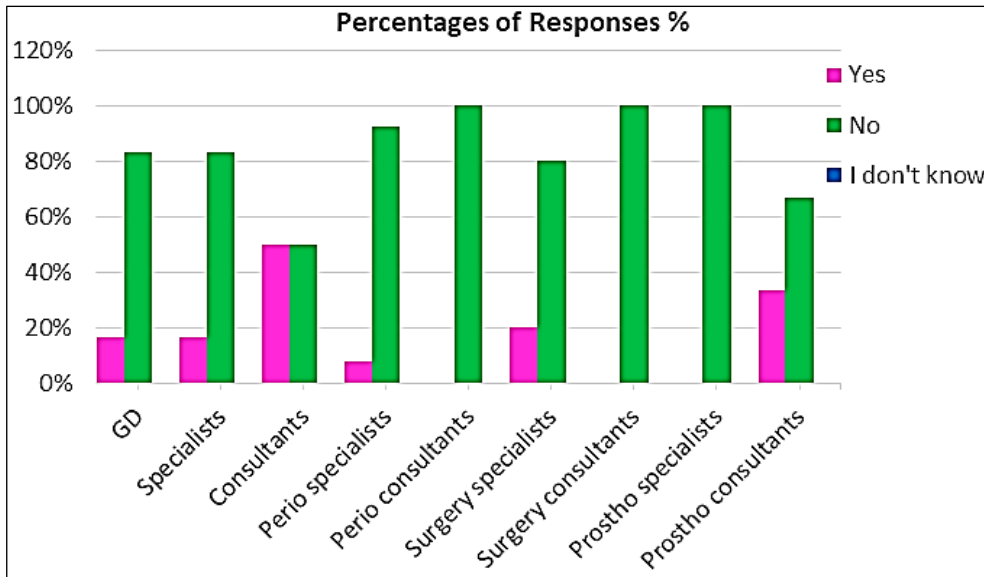


Chart 1: Percentages of Responses to Age and Peri-implantitis

Table 4: Questions 14-16

Specialty		Responses-Estimated Proportions (95% CI)											
		Q14 Vertical space for crowns and bridges				Q15 Vertical space for overdenture				Q16 Safety space from nerve canal			
		5 mm %	10 mm %	I don't know %	Total%	5 mm %	10 mm %	I don't know %	Total %	1 mm %	2 mm %	I don't know %	Total%
Implant* only	GD*	50	50	0	100	16.7	83.3	0	100	5.6	94.4	0	100
	Specialist	[40-60]	[40-60]			[9-24]	[76-91]			[1-10]	[90-99]	0	
	Consultant	50	33.3	16.7	100	41.7	41.7	16.6	100	16.7	83.3	0	100
		[40-60]	[24-42]	[9-24]		[32-51]	[32-51]	[9-24]		[9-24]	[76-91]		
		100	0	0	100	0	100	0	100	0	100	0	100
Perio*	Specialist	53.8	38.5	7.7	100	30.8	61.5	7.7	100	7.7	92.3	0	100
		[44-63]	[29-48]	[2-13]		[22-40]	[52-71]	[2-13]		[2-13]	[87-97]	0	
	Consultant	25	75	0	100	50	50	0	100	0	100	0	100
		[87-97]	[3-13]			[40-60]	[40-60]						
Surgery*	Specialist	40	60	0	100	20	80	0	100	0	100	0	100
		[30-50]	[50-70]			[12-28]	[72-88]						
	Consultant	0	100	0	100	0	100	0	100	0	100	0	100
		0	100	0	100	0	100	0	100	0	100	0	100
Prosthodont*	Specialist	0	100	0	100	100	0	0	100	0	100	0	100
		[57-76]	[24-42]										
	Consultant	66.7	33.3	0	100	0	100	0	100	0	100	0	100
		[57-76]	[24-42]										

\*Implant = Implantology, Perio = Periodontics, Surgery = Maxillofacial Surgery, Prosthodont = Prosthodontics, GD = General Dentist

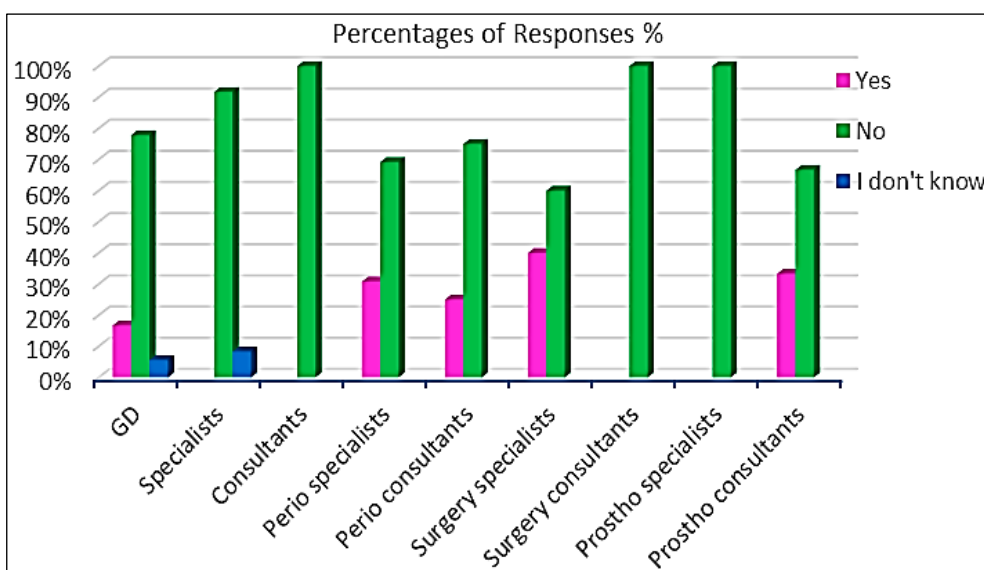


Chart 2: Percentages of Responses to Age and Implant Failure

**Table 5: Questions 17-19**

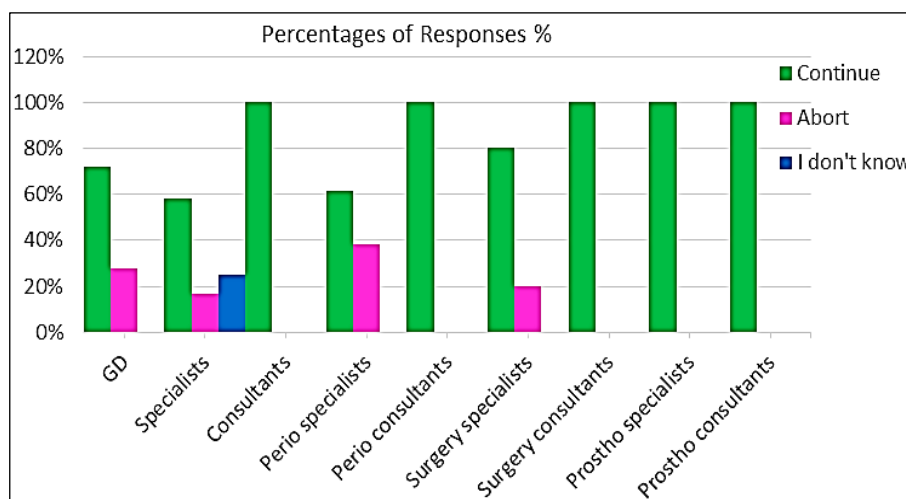
Specialty		Responses-Estimated Proportions (95% CI)												
		Q17 Age and implant Failure				Q18 Age and peri-implantitis				Q19 The most commonly affected during flap lifting				
		Yes %	No %	I don't know %	Total %	Yes %	No %	I don't know %	Total %	Mental nerve %	Mandibular alveolar nerve %	Lingual nerve %	I don't know %	Total %
Implant*	GD*													
	Specialist	16.7 [9-24]	77.8 [70-86]	5.6 [1-10]	100	16.7 [9-24]	83.3 [76-91]	0	100	50 [40-60]	16.7 [9-24]	33.3 [24-42]	0	100
	Consultant	0	91.7 [86-97]	8.3 [3-14]	100	16.7 [9-24]	83.3 [76-91]	0	100	50 [40-60]	8.3 [3-14]	25 [16-33]	16.7 [9-24]	100
Perio*	Specialist	30.8 [22-40]	69.2 [60-78]	0	100	7.7 [27-46]	92.3 [31-51]	0	100	53.8 [44-63]	15.4 [6-19]	30.8 [22-40]	0	100
	Consultant	25 [16-33]	75 [66-83]	0	100	0	100 [86-97]	0	100	25 [16-33]	25 [16-33]	50 [40-60]	0	100
	Consultant	0	100 [50-70]	0	100	0	100 [50-70]	0	100	0	0	100	0	100
Surgery*	Specialist	40 [30-50]	60 [50-70]	0	100	20 [12-29]	80 [72-88]	0	100	80 [72-88]	0	20 [12-28]	0	100
	Consultant	0	100	0	100	0	100 [50-70]	0	100	0	0	100	0	100
	Consultant	0	100	0	100	0	100	0	100	100	0	0	0	100
Prostho*	Specialist	0	100	0	100	0	100	0	100	100	0	0	0	100
	Consultant	33.3 [24-42]	66.7 [57-76]	0	100	33.3 [24-42]	66.7 [57-76]	0	100	66.7 [57-76]	33.3 [24-42]	0	0	100
	Consultant	0	100	0	100	0	100	0	100	100	0	0	0	100

\*Implant = Implantology, Perio = Periodontics, Surgery = Maxillofacial Surgery, Prostho = Prosthodontics, GD = General Dentist

**Table 6: Questions 20, 22, 23**

Specialty		Responses-Estimated Proportions (95% CI)											
		Q20 Sinus penetration of 1 mm				Q22 Space < 1 mm from the greatest diameter of the implant to the adjacent tooth				Q23 Patient can only afford to pay four implants			
		Continue %	Abort %	I don't know %	Total %	Keep %	Remove %	I don't know %	Total %	Overdenture %	1-2 units %	2-3 units %	Total %
Implant*	GD*	72.2 [63-81]	27.8 [19-36]	0	100	66.7 [57-76]	33.3 [24-42]	0	100	94.4 [88-99]	5.6 [1-10]	0	100
	Specialist	58.3 [49-68]	16.7 [9-24]	25 [16-33]	100	58.3 [49-68]	33.3 [24-42]	8.3 [19-36]	100	83.3 [76-91]	8.3 [3-14]	8.3 [3-14]	100
	Consultant	100	0	0	100	0	100	0	100	0	100	0	100
Perio*	Specialist	61.5 [52-71]	38.5 [29-48]	0	100	61.5 [52-71]	30.8 [22-40]	7.7 [2-13]	100	84.6 [77-92]	7.7 [3-13]	7.7 [3-13]	100
	Consultant	100	0	0	100	75 [66-83]	25 [16-33]	0	100	50 [40-60]	0	50 [40-60]	100
	Consultant	100	0	0	100	0	100	0	100	100	0	0	100
Surgery*	Specialist	80 [72-88]	20 [12-28]	0	100	80 [72-88]	20 [12-28]	0	100	100	0	0	100
	Consultant	100	0	0	100	0	100	0	100	100	0	0	100
	Consultant	100	0	0	100	0	100	0	100	100	0	0	100
Prostho*	Specialist	100	0	0	100	0	100	0	100	100	0	0	100
	Consultant	100	0	0	100	33.3 [24-42]	66.7 [57-76]	0	100	100	0	0	100
	Consultant	100	0	0	100	0	100	0	100	100	0	0	100

\*Implant = Implantology, Perio = Periodontics, Surgery = Maxillofacial Surgery, Prostho = Prosthodontics, GD = General Dentist



**Chart 3: Percentages of Responses to Schneiderian membrane tear (sinus penetration) of 1 mm occurred during operation**

Table 7: Question 21

Specialty		Responses-Estimated Proportions (95% CI)				
		Q21 Implant positional failure				
		Inappropriate Treatment Planning %	Poor surgical execution %	Inappropriate Treatment Planning and or Poor surgical execution %	I don't know %	Total %
Implant* only	GD*	5.6 [1-10]	0	94.4 [90-99]	0	100
	Specialist	16.7 [9-24]	0	83.3 [76-91]	0	100
	Consultant	0	0	100	0	100
Perio*	Specialist	7.7 [2-13]	0	84.6 [77-92]	7.7 [2-13]	100
	Consultant	0	0	100	0	100
Surgery*	Specialist	0	0	100	0	100
	Consultant	0	0	100	0	100
Prostho*	Specialist	0	0	100	0	100
	Consultant	0	0	100	0	100

\*Implant = Implantology, Perio = Periodontics, Surgery = Maxillofacial Surgery, Prostho = Prosthodontics, GD = General Dentist

## Discussion

Literature indicates to three phases of technical errors in implant dentistry which are preoperative, intraoperative, and postoperative [6, 7].

In their study that had a small sample size, Khadivi *et al.* [8] suggested that cardiovascular disease may not be a risk factor for successful osseointegration despite the fact that hypertension, atherosclerosis, vascular stenosis, coronary artery disease, and congestive heart failure which are examples of cardiovascular disease have direct impact on oxygen and nutrition supply to tissues.

Diabetes is known for its drawbacks that affect the vasculature, healing, and susceptibility to infection [9, 10]. In the same context, poorly controlled diabetes is a major risk factor for peri-implant bone loss [11] and diabetes should be considered as an important risk factor to implant complications and failure in individuals with poor glycemic control. Nevertheless, in well-controlled diabetic patients, there isn't a scientific evidence of increased implant failure rate [9, 10].

Periodontitis is considered the highest risk for implant failure, followed by tobacco smoking [11]. In addition, implants placed in the maxilla are more susceptible to smoking than implants placed in the mandible [10].

According to Byrne [12], The safety guidelines and spatial considerations for implant application should be as the following:

a bone thickness of 2-3 mm between two implant platforms, a minimum of 5 mm vertical space for crowns and bridges, a minimum of 10 mm vertical distance for implant overdenture, the implant must be placed at least 2.0 mm away from nerve canals, a mesiodistal space of 1.5-2.0 mm of bone should be available between the greatest diameter of the implant and the crowns and roots of adjacent teeth (a minimum of 1.0 to 1.5 mm of space mesially and distally is accepted too). When indicating to tooth roots, they are considered anatomic structures and must not be violated [12]. Mental nerve is the most commonly affected during flap lifting [13].

With respect to implant Failure, Al-Safadi *et al.* [14] found that age is not related to implant failure. Also, Dao *et al.* [15] concluded that implant failure rate is not correlated with age. In addition, Grant and Kraut [16] found that age is not a risk factor contributing to implant failure.

In Saudi Arabia, Al-Safadi *et al.* [14] found a significant relationship between peri-implantitis and the age of the

patient. Also, in Belgium, a positive correlation was found between peri-implantitis and age; patients aged  $\geq 65$  years were prone to peri-implantitis (OR = 1.39) [17]. However, in Sweden, it was found that age didn't influence the probability for subjects to exhibit peri-implantitis [18]. In addition, Dreyer and colleagues statistically analyzed studies that found relationship between age and peri-implantitis with studies that didn't find such a relationship; they concluded that there is medium-high evidence that patient's age (effect summary OR 1.0, 95% CI 0.87-1.16) is not related to peri-implantitis [19].

Reiser and colleagues classified the sinus membrane perforations into two classes: "Class I ( $\leq 2$  mm with exposure of the implant into the sinus cavity and loss of doming); Class II perforations ( $\geq 2$  mm) were associated with proximity of the osteotomy site to the medial wall of the sinus or the presence of septae" [20].

In the case of class II perforation that results in an exposed implant to the sinus cavity along with loss of space and dome shape, implant placement must be ceased, and surgical repair must be carried out either by closing the perforation with collagen, followed by grafting, and flap closure or by lateral window approach. However, in class I perforation that has good prognosis, implant placement should be continued as the membrane withholds the elevated space as well as the dome shape once the implant is placed.

In small perforations, the patient should be given systemic antibiotics with antihistamine and instructed to avoid blowing the nose [21].

With respect to implant positional failure, the most common type of it occurs due to poor treatment planning and or poor surgical execution [22, 23].

According to Byrne [12], mandibular full-arch fixed prosthesis: four to six anterior implants (one-to two-unit distal cantilevers), and maxillary full-arch fixed prosthesis: 4 to 6 anterior implants (1-or 2-unit cantilevers).

## Conclusion

All dentists practicing implantology should dynamically get involved in all aspects of the prevention and management related to complications in implant dentistry. Also, workshops and symposia are recommended.

**Funding:** None.

**Conflict of interest:** None declared.

**References**

1. Forum SJ. Implant complications: scope of the problem. In: Forum SJ, editor. *Dental Implant Complications: Etiology, Prevention, and Treatment*. Oxford: Wiley-Blackwell, 2010, 1-8.
2. Murray CM, Thomson WM, Leichter JW. Dental implant use in New Zealand: a 10-year update. *NZ dent J* 2016;112(2):49-54.
3. Togashi AY, Carmelo RA, Pereira NC. Level of knowledge of dentists about the diagnosis and treatment of peri-implantitis. *Dent Press Implantol.* 2014;8(1):30-38.
4. Al-Safadi R, Al-Safadi R, Al-Safadi R *et al.* Diagnosis and treatment of peri-implantitis among dentists in Saudi Arabia. *Int. J Emerg. Trends Sci. Technol* 2019;6(03):6787-6801.
5. Nunnally JC, Bernstein IH. eds. *Psychometric Theory*. 3<sup>rd</sup>. New York: McGraw-Hill 1994.
6. Pi-Anfruns J. Complications in implant dentistry. *Alpha Omegan* 2014;107(1):8-12.
7. Pinchi V, Varvara G, Pradella F, Focardi M, Donati MD, Norelli G. Analysis of professional malpractice claims in implant dentistry in Italy from insurance company technical reports, 2006 to 2010. *Int. J Oral Maxillofac Implants* 2014;29(5):1177-1184.
8. Khadivi V, Anderson J, Zarb GA. Cardiovascular disease and treatment outcomes with osseointegration surgery. *J Prosthet Dent.* 1999; 81(5):533-536.
9. Palmer RM, Howe LC, Palmer PJ, eds. *Implants in Clinical Dentistry*. 2<sup>nd</sup> ed. London: Informa Healthcare 2012.
10. Rose LF, Mealey BL. Implant complications associated with systemic disorders and medications. In: Forum SJ, editor. *Dental Implant Complications: Etiology, Prevention and Treatment*. Oxford: Wiley-Blackwell, 2010, 9-45.
11. Buhara O, Pehlivan S. Estimating the importance of significant risk factors for early dental implant failure: a Monte Carlo simulation. *Int. J Oral Maxillofac Implants* 2018;33(1):161-168.
12. Byrne G. ed. *Fundamentals of Implant Dentistry*. Ames, Iowa: John Wiley & Sons, 2014.
13. Ellies LG, Hawker PB. The Prevalence of altered sensation associated with implant surgery. *Int. J Oral Maxillofac Implants* 1993;8(6):674-679.
14. Al-Safadi R, Al-Safadi R, Al-Safadi R *et al.* Dental malpractice in implant dentistry in Saudi Arabia. *Int. J Emerg. Trends Sci. Technol.* 2019; 6(12):6855-6864.
15. Dao TT, Anderson JD, Zarb GA. Is osteoporosis a risk factor for osseointegration of dental implants? *Int. J Oral Maxillofac Implants.* 1993; 8(2):137-144.
16. Grant BT, Kraut RA. Dental implants in geriatric patients: a retrospective study of 47 cases. *Implant Dent* 2007;16(4):362-368.
17. Marrone A, Lasserre J, Bercy P, Brex MC. Prevalence and risk factors for peri-implant disease in Belgian adults. *Clin Oral Implants Res* 2013;24(8):934-940.
18. Fransson C, Lekholm U, Jemt T, Berglundh T. Prevalence of subjects with progressive bone loss at implants. *Clin Oral Implants Res* 2005;16(4):440-446.
19. Dreyer H, Grischke J, Tiede C *et al.* Epidemiology and risk factors of peri-implantitis: a systematic review. *J Periodontal Res* 2018;53(5):657-681.
20. Reiser GM, Rabinovitz Z, Bruno J, Damoulis PD, Griffin TJ. Evaluation of maxillary sinus membrane response following elevation with the crestal osteotome technique in human cadavers. *Int. J Oral Maxillofac Implants* 2001;16(6):833-840.
21. Rosen PS. Complications with the bone-added osteotome sinus floor elevation: etiology, prevention, and treatment. In: Forum SJ, editor. *Dental Implant Complications: Etiology, Prevention, and Treatment*. Oxford: Wiley-Blackwell, 2010, 310-324.
22. Chee W, Jivraj S. Failures in implant dentistry. *Br Dent J* 2007; 202(3):123-129.
23. Clark D, Barbu H, Lorean A, Mijiritsky E, Levin L. Incidental findings of implant complications on postimplantation CBCTs: a cross-sectional study. *Clin Implant Dent Relat Res* 2017;19(5):776-782.