

Correlates of knowledge and attitude towards dental implants: A cluster-sampling survey among general dental practitioners in the Asian macro-area

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Abstract

This study identifies the knowledge levels and attitude towards dental implants among general dental practitioners (GDPs). All registered GDPs in the State of Kuwait were invited to participate in this study. The questionnaire gathered information about the respondents' demographics, dental education, knowledge about dental implants, self-rating of implant competency and attitude towards dental implants. Multivariable linear regression analysis was performed to investigate the contribution of individual variables to the overall knowledge and attitude scores. Of the 1771

dentists invited to participate in this study, 467 (26.3%) participated in the survey. Cronbach's alpha knowledge score and attitude score was 0.716 and 0.798, respectively, indicating good internal consistency. The mean \pm SD knowledge score was 6.68 ± 2.4 and the mean attitude score was 4.63 ± 5.9 . Multivariable analysis showed that years of clinical experience, place of work, region of post-graduate training and self-rated implant competency were significantly associated with the attitude score ($p < 0.001$); and, years of clinical experience, specialty training, region of graduation, advanced dental implant training, and self-rated implant competency were significantly associated with the knowledge score ($p < 0.001$). The level of knowledge about dental implants was low and the respondents lacked the confidence to incorporate dental implants into their routine practice.

Keywords: Attitude; dentist; education; implants; knowledge.

INTRODUCTION

Restoring the function and aesthetics of missing teeth has been one of the main challenges in the dental profession (1). Inherent issues with the removable and fixed prosthesis, such as compromising healthy adjacent teeth, recurrent carious lesions, and the accumulation of plaque and food debris, have been reported

as major downfalls of these dental treatment options (2). Since the introduction of dental implants half a century ago, dentistry has shifted into a new paradigm that is the ability to replace missing teeth with osseointegrated dental implants. Since then, the concept of osseointegrated dental implants has been thoroughly studied and incorporated as an essential part of the dental curriculum and practice (3).

Dental implants, a breakthrough in oral rehabilitation, offer a permanent solution to tooth loss. Due to their superior functional and esthetic outcomes, dental implants are the preferred treatment option for the replacement of missing teeth (4, 5). They are one of the most predictable procedures in dentistry, with systematic reviews reporting a ten-year survival rate of over 94% (6-8). Elani et al.(9) reported an increase in the trend in the dental implant use in the United States This study predicted a jump from the 2016 prevalence of 5.7% to 17% in 2026.

The growing popularity of dental implants led to the increased need for more dentists to be involved in the delivery of dental implant care. Therefore, during the last two decades, implant dentistry has been increasingly incorporated in undergraduate curricula worldwide. However, challenges persist when it comes to offering adequate clinical training for future dentists. A systematic review revealed that basic theoretical education is the most common component of implant dentistry education at the undergraduate level with limited opportunities being offered in clinical education. Nonetheless, dental students are expected to meet a competence level where they are able to diagnose, treatment plan, surgically place implants, restore implants, and provide maintenance (10). At the undergraduate level, the majority of senior students at Tehran University expressed a positive attitude towards their didactic education in implant dentistry. However, they also believed that the clinical training was inadequate for them to perform dental implant procedures (11).

The learning experience of dental students through a coherent curriculum directly in-

fluences their clinical decision-making, and it has been shown that the dental students who acquired training in implant dentistry are more expectedly to deliver dental implant care for their patients (12). With the recent trends of general dental practitioners (GDPs) being more involved in dental implant treatment, it is essential that dental practitioners possess adequate skills and experience in the field of dental implants (13).

An extensive literature review revealed a paucity of studies pertaining to the knowledge and attitude among GDPs towards dental implants. A study was conducted in India that attempted to compare the knowledge, attitude, and practice of dental implants between postgraduate students, general dentists and institution-based practitioners. Post-graduates had the highest knowledge in dental implants, followed by institution-based practitioners and then GDPs, who also showed a highly negative attitude towards dental implants. This study concluded that dentists who obtained implant training expressed a positive attitude and practiced more in the dental implant field (14). Most of the published literature was specialty-oriented studies or opinion-based self-reported studies. For instance, a study in the United States mainly focused on the prosthodontists' experience and practice with dental implants (15). Another study has explored the opinion of dental practitioners in the UK with regards to the current level of dental implant education and experience as well as the barriers faced in providing dental implant treatment. It revealed that 77% of GDPs received didactic lectures related to implant dentistry, however, no clinical hands-on training was offered (16). A recent study in Nepal has explored knowledge, awareness, and attitude regarding dental implants among dental interns, they concluded that the majority of interns have dental implant knowledge and have a positive dental attitude towards gaining more information about implants (17).

With the increase in the demand for dental implant treatment, it is of paramount importance for dental practitioners, to demonstrate competency in the provision of dental implant

treatment to their patients. Therefore, the aims of this study were to assess the knowledge and attitude toward dental implants among GDPs and to identify the factors that can be associated with the knowledge and attitude toward dental implants in Kuwait.

MATERIALS AND METHODS

Ethical approval for this study was obtained from the Institutional Review Board of Health Science Center, Kuwait University (VDR/EC/3761; Dated: 30 June 2020). This cross-sectional study was conducted in full accordance with the World Medical Association Declaration of Helsinki. Informed consent was obtained from all the participants and this study is reported based on the guidelines of the strengthening the reporting of observational studies in epidemiology (STROBE) statement (18).

The study was carried out from July 1st, 2020 to October 30th, 2020, targeting GDPs working in Kuwait. Assuming 50% of the respondents have adequate implant knowledge levels [8], for a type-I error of 5% and power of 80%, it was calculated that a minimum of 400 subjects would be required. However, anticipating a low response rate, as observed with most electronic surveys (19), it was decided to include all the GDPs in Kuwait with active email accounts. A list of email addresses of all active GDPs was obtained from the Kuwait Dental Association. The total number of GDPs working in Kuwait was 1771 (Government sector=1114 and Private Sector=657). An email invitation to participate with a link to a questionnaire was sent to all GDPs via the Microsoft Office 365 Forms survey system. Assurance of anonymity and privacy were guaranteed to the respondents. The questionnaire consisted of 36 questions in a multiple-choice response format. Three reminder emails were sent on a monthly basis.

The questionnaire contained 4 sections: *Section 1* (demographics and dental education section): gathered information about the respondents age, gender, year of clinical prac-

tice, job title, work sector, location of practice, year of graduation, the region of graduation, post-graduate training and region, dental implant education, number of patients seen per week, and number of continuing education points obtained per year. *Section 2* (knowledge-based section): included the following questions, which were in the multiple-choice format; 1) most popular implant design currently used; 2) area of the mouth with the highest failure rate of implant osseointegration; 3) most common sign of implant failure; 4) minimum space required for 4.0 mm diameter implant; 5) minimum space between two implants; 6) minimum space between implant and tooth; 7) suitable candidates to receive dental implants; 8) accepted method for cleaning the titanium surface of the implant; 9) success rate of dental implant and 10) type of bone where the highest rate of implant failure occurs. *Section 3* (Self-rating of implant competency section): was assessed through the following questions: 1) knowledge of restorative and periodontal treatment for patients going to receive implants; 2) knowledge of surgical and prosthetic implant procedures; 3) most appropriate treatment option to replace missing teeth; 4) limitations of the esthetic outcome of implant treatment; 5) implant treatment risks involving peri-implant tissue destruction and combination of infection and inflammation; 6) success criteria and 7) long term prognosis for implant restorations, ability to diagnose and manage failed and failing implants and associated restorations. *Section 4* (Attitude section): consisted of self-reported Likert scale questions about willingness to: discuss the advantages/ disadvantages of dental implants, refer cases to specialists, chewing efficacy, esthetic outcome, maintenance costs, surgically procedure involved, need for workshops and training program on dental implants and confidence discussing dental implant options with your patients.

The knowledge, self-rated implant competency, and attitude-based questions were clustered to develop a total score. Each correct response to the knowledge questions received a score of 1. So, the knowledge score range was 1-10. Self-rating of implant competen-

cy was scored as: Limited (Score=1); Moderate (Score=2); Good (Score=3); Very Good (Score=4); Excellent (Score=5). Attitudes were elicited using Likert scales with -2 = strongly disagree, -1 = disagree, 0 = neutral, +1 = agree and +2 = strongly agree. Based on these points, a score was developed for attitude (range -16 to +16).

The validity of the questionnaire was confirmed in a pilot study involving 20 randomly selected GPDs working with the Ministry of Health – Kuwait (MoH). Cronbach's alpha test was used to evaluate the internal consistency and based on the results; the questionnaire was then refined accordingly to minimize measurement errors.

Statistical analysis

Normality assumption for knowledge and attitude scores were tested using the Kolmogorov-Smirnov (K-S) test and the Shapiro-Wilk test (20). One-way ANOVA and Student t-test were used to compare groups. Correlation between variables was assessed using Pearson correlation coefficients. Scale properties of knowledge and attitude scores were assessed using Cronbach's alpha. A multiple linear regression model using 'enter' method was developed to identify the predictors of knowledge and attitude scores. The covariates were entered into the model in a stepwise manner, retaining only those that were significant. P-values <0.05 were considered significant. Data were analysed using IBM SPSS Statistics for Windows, Version 25.0 (IBM, Armonk, NY, USA).

RESULTS

A total of 1771 dentists were invited to participate in this study, of which 467 (26.3%) completed the survey. Half of the respondents were between the ages of 20

and 30 years and the majority were women (66%). Almost half of the respondents graduated from Gulf Cooperation Council (GCC) or Kuwait and had less than 5 years of experience after graduation. The majority (60.6%) were working in the polyclinics of the Ministry of Health. Most (67.2%) of the participants did not have any formal post-graduate training, but more than three-fourth had taken advanced dental implant training (Table 1.)

Implant knowledge score

The Cronbach's alpha for questions assessing the knowledge level was 0.716 and all items were positively correlated with the overall score. Of these, the highest percentage of correct responses was recorded for the question on the cleaning of dental implant surfaces and implant success rates (about 80% each). The lowest percentage of correct responses was for the question on the area of the mouth with the highest implant failure rates (42%) (Table 2.) The mean \pm SD knowledge score was 6.68 ± 2.4 . Knowledge scores were significantly different between all the variables studied. Women and respondents in the age groups of 31-40 years had significantly higher knowledge scores compared to others ($p < 0.001$). Those dentists with years of clinical experience higher than 15 years showed significantly lower knowledge scores compared to those with fewer years of experience ($p < 0.001$). Consultants and specialists had the highest knowledge scores, and GDPs had the lowest ($p < 0.001$). The region of graduation was also significantly different between the groups with those who graduated from the United States having the highest scores. Similarly, dentists who received advanced level of dental implant training had higher scores compared to

Table 1 – Mean score of knowledge and attitude scores by respondent characteristics

Variables	n	Valid Percent (%)	Knowledge Score Mean±SD	p-value*	Attitude Score Mean±SD	p-value*
Overall	467	100.0	6.68±2.4		4.63±5.9	
Age						
20-30yrs	237	50.7	6.69±2.5	<0.001	5.27±6.1	<0.001
31-40yrs	151	32.3	7.92±1.7		6.41±3.4	
40 and above	79	16.9	4.27±1.4		-0.73±5.8	
Gender						
Female	308	66	6.93±2.3	0.001	4.69±5.3	0.711
Male	159	34	6.18±2.6		4.48±6.9	
Years of clinical experience after dental graduation						
<5	224	48.0	6.77±2.5	<0.001	4.97±6.0	<0.001
5-10	99	21.2	7.74±1.9		6.80±3.8	
11-15	67	14.3	7.23±2.1		5.79±3.3	
16-20	47	10.1	4.97±1.6		1.62±6.7	
>20	30	6.4	3.90±1.6		-3.06±5.7	
Current job title						
Resident	99	21.2	6.61±3.0	<0.001	3.91±7.8	0.001
Asst Registrar	121	25.9	6.67±2.1		5.81±3.7	
Registrar/Sr Registrar	93	19.9	7.51±2.3		4.81±4.9	
Consultant/Specialist/Sr Specialist	36	7.7	8.02±1.3		6.86±4.0	
General Practitioner	118	25.3	5.67±2.2		3.18±6.5	
Place of work						
Kuwait University	43	9.2	5.37±3.9	<0.001	0.81±10.0	<0.001
Government - Polyclinic	283	60.6	6.56±2.2		4.87±5.1	
Government Specialty	56	12.0	8.57±1.3		6.71±3.4	
Government and Private	21	4.5	8.85±1.1		8.62±2.7	
Private Practice	64	13.7	5.70±1.8		2.94±6.1	
Region of graduation						
Far East+Other	11	2.4	7.09±2.3	<0.001	3.18±1.7	<0.001
GCC+Kuwait	232	49.7	7.28±2.5		4.90±5.8	
Other Middle-East	164	35.1	5.65±2.2		2.79±5.9	
UK	23	4.9	5.26±1.9		6.91±3.8	
US	37	7.9	8.19±1.3		10.03±3.4	

Variables	n	Valid Percent (%)	Knowledge Score Mean±SD	<i>p</i> -value*	Attitude Score Mean±SD	<i>p</i> -value*
Post-graduate/specialty training						
AEGD	51	10.9	8.07±1.6	<0.001	1.58±9.5	<0.001
GPR	28	6.0	6.42±2.2		6.46±3.7	
KBGD	74	15.8	7.89±1.9		6.35±3.2	
None	314	67.2	5.73±3.5		4.55±5.6	
Region of post-graduate training						
GCC	123	77.8	6.90±2.9	0.008	3.65±6.7	<0.001
US	22	13.9	8.86±0.8		9.23±2.1	
UK + Others	13	8.2	7.08±1.3		8.69±3.7	
Advanced dental implant training						
Yes	353	75.6	7.26±2.3	<0.001	5.46±5.6	<0.001
No	114	24.4	4.85±2.0		2.03±6.1	
Self-rated Implant competency						
Low	239	51.2	5.64±2.5	<0.001	1.82±6.3	<0.001
High	228	48.8	7.76±1.8		7.57±3.5	
SD – standard deviation; *Independent sample t-tests for two categorical variables and ANOVA tests for variables with more than two categories						

others. Dentists who pursued Advanced Education of General Dentistry (AEGD) training had the highest scores and those who did not pursue had the lowest scores ($p<0.001$) (Table 1.)

Implant attitude score

The Cronbach's alpha for questions assessing the attitude level was 0.798 and all items were positively correlated with the overall score. The mean \pm SD attitude score was 4.63 ± 5.9 and the range was -16 to +16. Dentists over the age of 40 years and those with more than 20 years of clinical experience recorded negative attitudes towards implant treatment ($p<0.001$). Dentists working in both the government and private sectors had the highest attitude scores compared to others ($p<0.001$). Similarly, dentists who graduated from the US or had received their post-graduate training from US had significantly

better attitude scores compared to the rest ($p<0.001$) (Table 2.)

Stepwise linear regression assessing the relationship between various covariates with total knowledge scores and total attitude scores showed several significant (adjusted) associations (Table 3.) The independent variables that were included in the final model for knowledge scores were: Years of clinical experience, specialty training, region of graduation, advanced dental implant training, and self-rated implant competency. The adjusted R square for the model was 57.1%. Regression analysis, using attitude score as a dependent variable and the covariates of years of clinical experience, place of work, region of post-graduate training, and self-rated implant competency as independent variables showed that all the variables were significantly associated with the attitude score ($p<0.001$). The variability of attitude score as represented by the adjusted R square was 34.5%.

Table 2 – Proportion of correct responses to implant knowledge questions (n=467)

Q. No:	Knowledge Items	Correct responses
		N (%)
1	Which is the most popular design of dental implant?	
	Correct answer: Root form implant	309(66.2)
2	Which area of the mouth has the highest failure rate in osseointegration of dental implants?	
	Correct answer: Posterior Maxilla	196(42.0)
3	What is the most common sign of implant failure?	
	Correct answer: Mobility	321(68.7)
4	What is the minimum space required for a 4.0 mm diameter implant?	
	Correct answer: 7mm	296(63.4)
5	What is the minimum space required between two implants?	
	Correct answer: 3mm	311(66.6)
6	What is the minimum remaining bone between the implant and the tooth?	
	Correct answer: 1.5mm	339(72.6)
7	Which of the following conditions can be a suitable candidate for dental implant placement treatment?	
	Correct answer: Advanced patient age	296(63.4)
8	Which of the following is NOT acceptable for cleaning titanium surfaces of dental implant?	
	Correct answer: Ultrasonic tips	374(80.1)
9	In patients with normal bone and normal healing capabilities, one should anticipate a dental implant success rate of?	
	Correct answer: 90-95%	371(79.4)
10	The highest rate of implant failure occurs in?	
	Correct answer: Type 4 bone	306(65.5)

Self-rated implant competency

Table 4 shows the frequency distribution of the responses to the questions assessing the respondent's self-assessment of their implant competency. Almost 30% of the respondents reported limited knowledge in diagnosing and managing implant failures. The high proportion of 'Very good' or 'excellent' self-rated competency was observed for the respondents' ability to decide the most appropriate treatment options for missing teeth.

Dental implant practice

Table 5 shows the practice pattern of the respondents. About three-fourth of the respondents reported not routinely placing dental implants, though the majority (76.7%) expressed interest in taking courses that offer surgical implant placement. Most dentists (57%) reported routinely discussing the advantages and disadvantages of dental implant treatment with their patients.

Table 3 – Multivariable linear regression model for dental implant knowledge and attitude scores

	Unstandard- ized Beta	Coefficients Standard Error	Standardized Coefficients Beta	P-value
Knowledge Score				
Constant	-0.35	0.86		0.69
Years of clinical experience after dental graduation	0.72	0.14	0.34	<0.001
Post-graduate/specialty training	0.82	0.21	0.28	<0.001
Region of Graduation	1.07	0.24	0.28	<0.001
Advanced Dental Implant Training	-1.82	0.47	-0.21	<0.001
Self-rated Implant compe- tency	2.38	0.31	0.42	<0.001
Adjusted R Square = 57.1%				
Attitude Score				
Constant	-5.68	1.06		<0.001
Years of clinical experience after dental graduation	-1.51	0.21	-0.33	<0.001
Place of work	0.62	0.18	0.15	<0.001
Region of post-graduate training	1.41	0.24	0.22	<0.001
Self-rated Implant compe- tency	5.38	0.45	0.45	<0.001
Adjusted R Square = 34.5%				

DISCUSSION

This study assessed the overall knowledge and attitude towards dental implant treatment in a Nationally representative sample of GDPs.

The dental implant knowledge score revealed that participants with postgraduate advanced education training and higher job titles (consultant, senior specialist, and specialist) had higher implant knowledge scores. This finding is in line with a previous study as they attributed this finding to the fact that advanced education training and hands-on courses enhance knowledge and skills of implant treatment requirements (14). Also, participants of 40 years of age and younger have demonstrat-

ed higher knowledge scores. This finding is associated with the investiture of dental implantology within the dental education curriculum dated in early the 1990s. Due to the increasing demand for dental implant treatment as a pivotal treatment modality, 97% of U.S. and 86% of Canadian dental schools offered theoretical and clinical exposure in restoring dental implants in the predoctoral implant dentistry curricula, and similar percentages noted in the U.K (21, 22). It was also reported that dentists who graduated before the 1980's have less dental implant experience and knowledge as the concept of osseointegration and dental implantology was introduced thereafter (23). Interestingly, GDPs with more than 15 years of clinical experience had lower implant knowledge scores compared with those with lesser

Table 4 – Frequency distribution of responses to questions assessing the respondents' self-rated implant competency

Question	Limited (Score=1)	Moderate (Score=2)	Good (Score=3)	Very Good (Score=4)	Excellent (Score=5)
How would you rate your...					
1) ...basic knowledge of how to perform restorative and periodontal treatments for patients who are going to receive dental implants	80 (17.1)	106 (22.7)	99 (21.2)	114 (24.4)	68 (14.6)
2) ...knowledge of the surgical and prosthetic procedures involved in implant treatment	109 (23.3)	102 (21.8)	88 (18.8)	118 (25.3)	50 (10.7)
3) ...ability to decide on the most appropriate treatment option to replace missing teeth (between RPD/FPD/Implants)	76 (16.3)	70 (15.0)	107 (22.9)	131 (28.1)	83 (17.8)
4) ...knowledge of the possibilities and limitations with respect to the aesthetic outcome of implant treatment	83 (17.8)	106 (22.7)	113 (24.2)	129 (27.6)	36 (7.7)
5) ...awareness of the risks of- and treatment options for peri-implant tissue destruction due to a combination of infection and inflammation	94 (20.1)	108 (23.1)	100 (21.4)	125 (26.8)	40 (8.6)
6) ...knowledge of the criteria for success and long-term prognosis of oral implants and associated restorations	86 (18.4)	100 (21.4)	105 (22.5)	119 (25.5)	57 (12.2)
7) ...ability to diagnose and manage failing and failed implants and associated restorations	136 (29.1)	102 (21.8)	100 (21.4)	95 (20.3)	34 (7.3)

years of clinical experience. This finding is in accordance with Eckert et al. (15) who concluded that dentist with many years of practice, still favour conventional treatment options in replacing edentulous areas than using dental implants. The study investigated dental implant attitude among GDPs where the results showed that participants of 40 years of age and older and participants with > 20 years of experience had a negative attitude toward dental implant treatment. This finding can be attributed to the facts mentioned previously

with regards to the time frame of introducing dental implant education to most dental curricula in the 1990s, therefore, explaining the deficient knowledge of dental implantology, which directly reflects on the attitude of dental practitioners toward dental implants (14, 24). In this study, the 'region of graduation' variable indicated that U.S graduates scored the highest in term of dental implant knowledge. This could be related to the implementation of dental implantology curricula in more than 86% of the predoctoral dental programs since

Table 5 – Dental implant practice among the respondents		
Variables	n	(%)
On average, how many patients do you personally see in a typical week?		
<25	160	34.3
26-50	21	4.5
51-75	215	46.0
>75	71	15.2
Do you routinely place dental implants?		
Yes	114	24.4
No	353	75.6
Approximately how many CE (Continuing Education) points on dental implants have you earned?		
<25	158	33.8
26-50	147	31.5
51-75	91	19.5
75-100	29	6.2
>100	42	9.0
Do you offer dental implant option routinely to patients with missing teeth?		
Yes	365	78.2
No	102	21.8
How often do you discuss dental implants as a treatment option with your patients?		
Rarely	183	39.2
Frequently	284	60.8
How often do you discuss the advantages and disadvantages of dental implant treatment?		
Rarely	198	42.4
Frequently	269	57.6

1993, leading to high exposure to dental implant concepts (25, 26). Nevertheless, U.S graduates and participants who received advanced dental implant training have demonstrated a positive attitude toward providing treatment of implants, and this can also be linked to the above-mentioned reasons.

GDPs who worked in both government and private sectors displayed a positive attitude towards offering dental implant treatment. This finding can be interrelated to variable factors such as dental literacy of patients with regards to dental implants, patients' financial

level, and dental setting to perform such procedure (27).

As described previously, self-assessment is an important step by which individuals can identify their learning needs. This leads to additional efforts by the individual towards more self-directed learning. This study was able to identify respondents' self-rated competency on the different aspects of implant therapy (28). The current study has explored the aspect of dental implant practice among GDPs where 24.4% of the participants did place and/or restore dental implants. A worldwide compar-

ison of practicing surgical/prosthetic dental implant procedures revealed that 70.1% of the GDPs in Australia are practicing implant dentistry, 61% in Hong Kong, 53% in the United States, 68% in New Zealand, and 1.3% in Nigeria (27, 29-31). This concluded that the practice of dental implant among GDPs in Kuwait falls in the lower percentile compared to many other countries.

The majority of the participants displayed high interest in taking courses that offer surgical implant placement. This finding can benefit health policymakers, on one end, in offering advanced dental implant hands-on training in addition to providing the appropriate clinical setting for trained GDPs to perform implant surgical/prosthetic procedures. On the other end, dental educators may consider offering a full-time and/or part-time post-graduate level training in oral implantology, as provided in many developed countries. Moreover, most of the participants reported that they offer dental implants as a treatment option as well as discussing implant advantages and disadvantages with patients. The GDPs' ability to discuss dental implant as a treatment option was associated with receiving theoretical dental implant education as undergraduates plus taking continuing education courses (16).

In order to elevate the level of knowledge and clinical experience of GDPs, it is essential to design dental implant courses that target GDPs and focus on clinical, hands-on training. Dentists with more clinical experience in implant dentistry are four-times more confident in diagnosis and treatment planning a single implant crown, four-times more confident in selecting implant parts for restoring a single implant crown, eight-times more confident in treating patients with a single implant crown in their private practice, and five-times more satisfied with their implant education (32). Universities, dental associations, and implant companies are the main providers of such courses, where dentists are closely supervised and mentored. The challenge is that these courses vary tremendously and each course is a reflection of its director's objectives. Hence, standardization is key to guarantee that every dentist is performing at the highest level of

professional and ethical standard and providing high quality care in a uniform and universal manner (33).

One of the major limitations of this study is the low response rate, which could have introduced response bias. As more than half of the GDPs invited to participate in this survey were non-responders, there was potential for response bias if non-responders differed significantly from responders. Since this survey was conducted electronically, it was not possible to contact dentists to gather information on the reasons for non-participation. Response rates of electronic surveys have been reported to be low due to survey fatigue (19). Nevertheless, it is accepted that those who respond to surveys tend to have a higher interest in the subject of the survey than those who do not. Therefore, any bias that might have resulted from the low response rate would likely have overestimated knowledge, attitudes, and practice of the GDPs.

This study indicated that both GDPs who graduated from the United States and those who received courses in dental implants scored higher in knowledge and attitude. Also, GDPs who combined working in both private and government sectors showed positive attitude towards dental implants. On the other hand, GDPs with more than 20 years of experience displayed a negative attitude towards dental implants. Therefore, it can be concluded that the gaps identified in the knowledge and practice of dentists support the need to introduce continuing education for GDPs to minimize barriers and increase their confidence in providing dental implants to their patients.

Kuwait has a high proportion of general dentists and therefore it is of paramount importance to understand the attitude and practice of dental implants in this community. The results of this study would help in planning future continuous dental education programs to increase the acceptance and use of dental implants by GDPs.

Declaration of Competing Interests

The authors declare no conflict of interest.

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