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Actual Practical Attitude and Knowledge of Dental Implants among Senior Dental Students and General Dentists Graduated from Some Saudi and Non-Saudi Dental Schools

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Abstract

Objective: To assess the actual practical attitude and knowledge of dental implants among senior dental students and general dentists graduated from some Saudi and Non-Saudi dental schools. **Methods:** A total of 300 senior dental students and general dentists participated in the study. Hard copies of the self-designed, multiple-choice questionnaires were distributed to all participants. The questionnaire consisted of 31 questions in five parts. Data were collected and analyzed using Chi-square test and t-test, where $p < 0.05$ was calculated to be statistically significant and $p < 0.001$ to be statistically highly significant. **Results:** There is a statistically significant relationship between the participants' answers, and their dental schools. Participants' general knowledge, training, and teaching of dental implants, as well as information about restorations retained for the dental implants, were higher among participants from Saudi dental schools than participants from non-Saudi dental schools, while the information about dental implants was higher among participants from non-Saudi dental schools than participants from Saudi dental schools. **Conclusion:** We conclude that the actual practical attitude and knowledge of dental implants among participants in the current study was insufficient. Therefore, dental implant education in the undergraduate curricula of dental schools surveyed should be updated to include teaching, laboratory training, and preclinical and clinical training.

Keywords

Knowledge, Dental Implants, Dental Schools, Non-Saudi,

Practical Attitude, Saudi

1. Introduction

Until the last decade, dental implant treatment was restricted to specialists. But recently, there has been an increase in interest in dental implants among senior dental students and general dentists to educate themselves, train and develop their skills in this type of dental treatment [1]. Furthermore, the high success rate of dental implant treatment and increased acceptance of patients undergoing dental implant treatment means that general dentists must know the maintenance of dental implants and the principles of dental implants technique [2].

As we know, dental implants are artificial roots used as a therapeutic method to replace missing teeth due to periodontal diseases, trauma, infections, developmental abnormalities, and tumors and used as support for prosthetics. In addition, this method is an acceptable and reliable treatment procedure for restoring esthetics and function in patients with partial or complete edentulous [3] [4] [5] [6]. Therefore, dental implants have helped preserve adjacent teeth and alveolar bone, increase patients acceptance and satisfaction and have developed as a rapid treatment option for oral rehabilitation, as well as being non-destructive for more than ten years [7] [8] [9] [10]. Several factors may influence the clinical success of a dental implant, such as the patient's general health, oral hygiene, smoking, occlusal loads, and the type of restorations retained on the implant [11] [12] [13].

The implant retention system can be either screw or cement-retained restorations, chosen according to the advantages and disadvantages of each system [14]. There are advantages to screw-retained restorations such as rare biological complications, ease of installation, ability to be used in poor position of implants, and in cases of minimal arch spacing (less than 4 mm) due to direct screw-on fixation [15] [16]. There are drawbacks to screw-in restorations, such as high cost, high skills requirements, and unwanted esthetic due to the screw access channel which can cause the ceramic to weaken [17] [18] [19] [20]. On the other hand, there are advantages to cement-retained restorations such as excellent esthetics, flexibility in positioning, and good occlusal contacts [17] [21] [22] [23]. But incomplete cement removal is the main drawback and causes biological complications such as periodontal tissue inflammation and bone loss [24] [25].

In the kingdom of Saudi Arabia, there are no quantitative or qualitative studies that provide a clear picture of the teaching and training dental implants in Saudi universities except two studies in 2009 G as well as 2018 G that showed that the teaching dental implants varied greatly among dental schools [24] [26]. Furthermore, there has been a decrease in the percentage of dental schools in the USA that included dental implantology in their curriculum, but there has been an increase in dental schools offering dental implantology courses as part of

their curriculum from 33% in 1974 to 86% in 2005, compared to 10% of the European dental schools that introduced dental implantology courses in their curriculum before 1990 and then rising to 80% in 2001 [27] [28]. The current study aims to evaluate the actual practical situation and knowledge of dental implants among senior dental students and general dentists who graduated from some Saudi and Non-Saudi dental schools concerning graduation schools. Thus, the primary objective of this study was to assess the effect of the participants' graduation schools on the actual practical attitude and knowledge of dental implants among senior dental students and general dentists.

2. Material and Methods

2.1. Population and Study Design

This cross-sectional study included 300 participants (150 participants from some Saudi dental schools and 150 participants from some non-Saudi dental schools, 50% male and 50% female) as follows: Eighty-eight senior dental students (5th and 6th years and interns), and 212 dentists (102 dentists who graduated less than five years ago, in addition to 110 dentists who graduated more than five years ago). This study was conducted from November 2021 AD to March 2022 AD. The participants were selected from the students and graduates of some Saudi dental schools in the kingdom of Saudi Arabia and some non-Saudi dental schools in the Republic of Yemen. Demographic details of the participants (age, gender, dental school levels of undergraduate education, and duration of graduation) were recorded.

2.2. Ethical Aspects

Informed consent was obtained from the participants, and the study proposal was registered and designed in accordance with the instructions of the Institutional Review Board (IRB), college of dentistry, King Khalid University (IRB/REG/2022-2023/52). Participants' cooperation was voluntary, and anonymity and data were secured. Study objectives were explained to all study participants.

2.3. Inclusion and Exclusion Criteria

Inclusion criteria were as follows: Senior dental students (5^{th} and 6^{th} years), dental interns, and general dentists who signed the consent form. Exclusion criteria were as follows: junior dental students (before the Fifth year) and participants who refused to sign of the consent form.

2.4. The Sample Size

The minimum sample size should be 295 participants to obtain statistically significant results with an accuracy level of 5% and a confidence level of 90%.

2.5. Questionnaire Design

An English-language questionnaire was designed to collect data in the current

study. The questionnaire content was obtained from previous studies' questionnaires with some modifications for internal reader reliability and then checked and tested by Cronbach's alpha test. A hard copy of the questionnaire was distributed to each participant. Answers to the survey questions took approximately six minutes. The questionnaire included 31 questions in five parts to assess the actual practical situations and knowledge of dental implants among senior dental students and general dentists who graduated from some Saudi and non-Saudi dental schools. The first part consisted of seven demographic questions related to age, gender, university level, date of graduation, years of experience, place of work, and place of university study.

The second part included six multiple-choice questions related to general Knowledge in the subjects of dental implants as a branch of dentistry, the distance between dental implants, the distance between the dental implant and natural teeth, the distance between the dental implant and the maxillary sinus, indications and contraindications for dental implants, and the experience in dental implants. The third part included seven questions about dental implant training and education if there were limitations in funds or supplies for the study of dental implants.

These limitations included the difficulties of teaching dental implants during the undergraduate level, workshops, seminars, and clinical training in addition to enquiring about the role of dental implant companies in dental implant training during the undergraduate level, and we asked them if they wanted to be dental implants specialists.

The fourth part asked four questions about participants' information regarding dental implants topics related to the source of this information and whether this information is sufficient and the most important factor for the success of dental implants, in addition to one question about the parts of dental implant.

The final part (seven questions) assessed the participants' Knowledge regarding the topic of dental implant retained-restorations, their types and which implant restoration are better aesthetically, fracture resistance, retention, control of periodontal complications, ease of fabrication as well as which of these factors more important in selecting retained restorations. Three hundred hard copies of the questionnaires along with cover letters containing instructions and objectives of the study were distributed to the participants in this study.

2.6. Statistical Analysis

The statistical analysis of the collected data was performed using Chi-square test and t-test. A t-test of the mean and standard deviation was used to compare an analysis of participants' ages according to their graduation schools with $p < 0.05$ statistically significant and $p < 0.001$ highly statistically significant. A Chi-square test was used to compare the percentages distribution of participants according to their graduating schools, and the answers collected for each question among participants.

3. Results

Three hundred participants returned the questionnaires. All questions have been fully answered. Distribution of participants according to graduation schools and education levels Table 1 and Figure 1. Of the total participants, 29.3% (n = 88) were senior dental students, 34% (n = 102) were graduates (<5 years), and 36.7% (n = 110) were graduates (≥5 years).

On the other hand, 40 (26.7%) of senior dental students were graduates of some Saudi dental schools, 48 (32%) were graduates of some non-Saudi dental schools, and 52 (34.7%) of general dentists (<5 years) were graduates of some Saudi dental schools and 50 (33.3%) graduates of some non-Saudi dental

Table 1. Distribution of participants according to schools of graduation and levels of education.

	Number of participants		Chi-square	
	Gs SDSs (n = 150)	Gs NSDSs (n = 150)		
Participants (n = 300)	n (%)	n (%)	Pearson Chi	P-value
SDSs (n = 88) (29.3%)	40 (26.7%)	48 (32%)	37.28	0.05*
GDs (Gs < 5 years) (n = 102) (34%)	52 (34.7%)	50 (33.3%)	43.24	0.031*
GDs (Gs ≥ 5 years) (n = 110) (36.7%)	58 (38.6)	52 (34.7%)	21.36	0.049*
Chi-square				
SDSs & Gs <5 years & Gs ≥5 years			26.18	<0.005**

Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non Saudi dental schools, SDSs: Senior dental students, Gs: Graduates, n: Number, Gs: Graduates, GDs: General dentists. *Statistically significant differences, **Highly statistically significant differences.

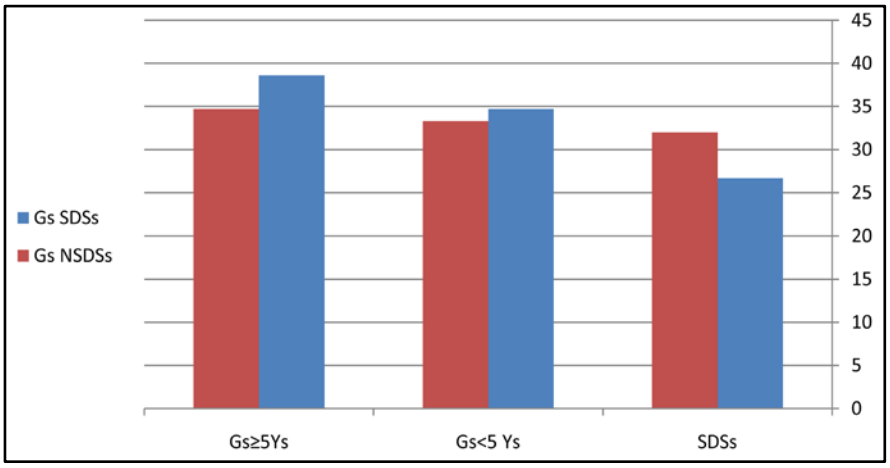

Figure 1. Distribution of participants according to schools of graduation and levels of education. Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non Saudi dental schools, Gs: Graduates, Ys: Years, SDSs: Senior dental students.

schools, as well as 58 (38.6) of general dentists (≥5 years), were graduates of some Saudi dental schools and 52 (34.7%) were graduates of some non-Saudi dental schools. Consequently, the graduates of some Saudi dental schools participating in this study were more than the graduates of some non-Saudi dental schools, except for participating senior dental students, where the graduates of some non-Saudi dental schools participating were more than the graduates of some Saudi dental schools, with a statistically significant difference ($p < 0.05$).

Table 2 and Figure 2 describe the mean and standard deviation of the participants' ages. The mean ages of graduates of some Saudi dental schools and graduates of some non-Saudi dental schools senior dental students participants were 24.22 and 24.12 years old, while the mean ages of graduates of some Saudi dental schools and graduates of some non-Saudi dental schools general dentists participants (<5 years) were 28.79 and 27.43 years old as well as the mean ages of graduates of some Saudi dental schools and graduates of some non-Saudi dental schools general dentists participants (≥5 years) were 30.72 and 29.00 years old.

Table 2. The mean and standard deviation of the participants' ages.

Participants	Mean ± SD of Age				t-test	P value
	Gs SDSs		Gs NSDSs			
	Mean	±SD	Mean	±SD		
SDSs	24.22	0.878	24.12	1.201	−2.33	0.020*
GDs (Gs <5 years.)	28.79	0.884	27.43	1.073	−2.36	0.022*
GDs (Gs ≥5 years)	30.72	1.018	29.00	1.118	−0.874	0.386

Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non Saudi dental schools, SDSs: Senior dental students, Gs: Graduates, GDs: General dentists, SD: Standard deviation.

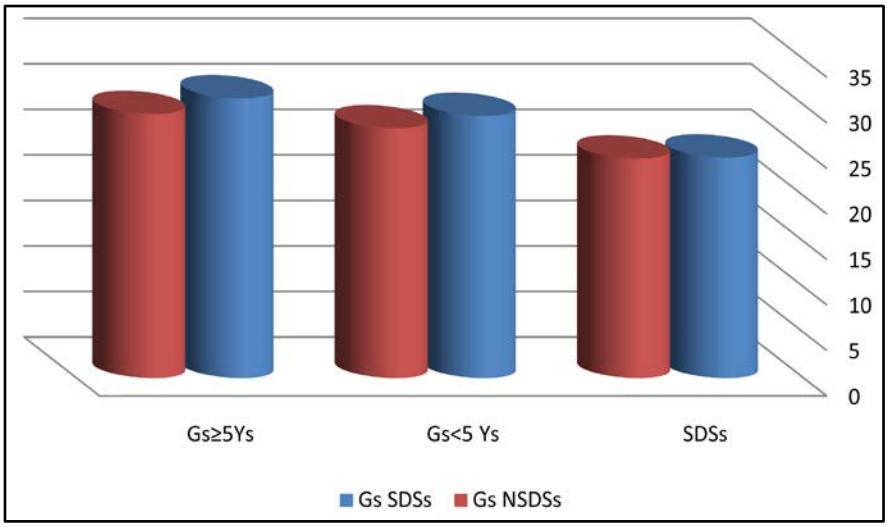

Figure 2. The mean and standard deviation of the participants' ages. Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non-Saudi dental schools, Gs: Graduates, Ys: Years, SDSs: Senior dental students.

Thus, the mean ages of general dentists participants (≥5 years) were more than general dentists participants (<5 years.) and senior dental students participants. Moreover, the mean ages of graduates of some Saudi dental schools participants were more than graduates of some non-Saudi dental schools participants with statistically significant differences ($p < 0.05$) except general dentists participants (≥5 years), where there were no statistically significant differences ($p > 0.05$).

Regarding the answers to the general Knowledge dental implants questions (Table 3). In the answers to the first question, 88.6% of graduates of some Saudi dental schools and 88% of graduates of some non-Saudi dental schools reported that they know that there is a branch of dentistry called implantology. The remaining graduates of some Saudi dental schools and graduates of some non-Saudi dental schools reported that they didn't know whether there was a branch of dentistry called implantology.

Table 3. Participants' answers to the general knowledge dental implants questions.

Questions		Gs SDSs (n = 150)	Gs NSDSs (n = 150)	Chi (P value)
		n (%)	n (%)	
Did you know that there is a branch of dentistry called implantology?	I don't know	17 (11.4%)	18 (12%)	23.7 (0.541)
	Yes	133 (88.6%)	132 (88%)	
How much distance between two implants must be present during the surgical procedure?	1 mm	7 (4.7%)	21 (14%)	8.8 (0.032*)
	2 mm	28 (18.7%)	25 (16.7%)	
	3 mm	97 (64.7%)	82 (54.7%)	
	4 mm	18 (12%)	22 (14.7%)	
How much distance between the dental implant and natural teeth must be present during the surgical procedure?	1 - 1.5 mm	54 (36%)	54 (36%)	3.9 (0.271)
	2 - 2.5 mm	42 (28%)	38 (25.3%)	
	3 - 3.5 mm	22 (14.7%)	34 (22.7%)	
	4 - 4.5 mm	32 (21.3%)	24 (16%)	
How much distance between the dental implant and the maxillary sinus must be present during the surgical procedure?	0 - 1 mm	81 (54%)	69 (46%)	16.4 (0.001**)
	1.25 - 2 mm	38 (25.3%)	50 (33.3%)	
	2.25 - 3 mm	19 (12.7%)	18 (12%)	
	3.25 - 4 mm	12 (8%)	13 (8.7%)	
Do you know the essential indications and essential contraindications of dental implants?	I don't know	43 (28.7%)	30 (20%)	13.5 (0.001**)
	No	48 (32%)	54 (36%)	
	Yes	59 (39.3%)	66 (44%)	
Do you have any experience in dental implants?	No	75 (50%)	107 (71.3%)	14.3 (<0.001**)
	Yes	75 (50%)	43 (28.7%)	

Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non Saudi dental n: Number, *Statistically significant differences, **Highly statistically significant differences.

In the answers to the second question regarding the distance between two implants that should be present during the surgical procedure, 64.7% of graduates of some Saudi dental schools and 54.7% of the graduates of some non-Saudi dental schools chose the correct answer, while the remaining the graduates of some Saudi dental schools and the graduates of some non-Saudi dental schools chose the wrong answers.

Regarding the answers to the third question about the distance between the dental implant and natural teeth, 36% of graduates of some Saudi dental schools and 36% of graduates of some non-Saudi dental schools chose the correct answer, while the remaining participants chose the wrong answers.

In the answers to the fourth question regarding the distance between the dental implant and the maxillary sinus, 54% of the graduates of some Saudi dental schools and 46% of the graduates of some non-Saudi dental schools chose the correct answer, while the remaining participants chose the wrong answers.

In the answers to the fifth question, 39.3% of the graduates of some Saudi dental schools and 44% of the graduates of some non-Saudi dental schools reported that they know the indications and essential contraindications of dental implants. In contrast, 50% of graduates of some Saudi dental schools and 28.7% of graduates of some non-Saudi dental schools said that they had experience in dental implants in the answers to the sixth question.

There are significant differences in the answers to the second question ($p < 0.05$) and highly significant differences in the answers to the fourth, fifth, and sixth questions ($p < 0.001$), while there are no significant differences in the answers to the other remaining questions ($p > 0.05$).

The academic education of dental implant training among the participants in the current study is summarized in Table 4.

59.3% of the graduates of some Saudi dental schools and 72.7% of the graduates of some non-Saudi dental schools think there are limitations on funding or supplies for studying dental implants. Moreover, 79.3% of graduates of some Saudi dental schools and 83.3% of graduates of some non-Saudi dental schools in this study reported that they did not take dental implants training during their undergraduate studies, except dental implants lectures in some courses (35.3% and 30.7%). Therefore, most participants reported that they want to participate in workshops and seminars on dental implants (79.3% and 74.6%).

On the other hand, regarding the question of implant companies supporting implant training during undergraduate studies, the participants reported that it included the implants (30.7% and 25.3%), the simulated models (26.7% and 32%), the components restorative (20% and 21.3%), the lab training funding (16.6% and 16%) and clinical training funding (6% and 5.4%).

Regarding the questions about implant procedures, 20.7% of graduates of some Saudi dental schools and 16.7% of graduates of some non-Saudi dental schools reported that they carried out implant procedures. Moreover, more than half of the participants confirmed that they want to be specialists in dental implants (74% and 63.4%).

Table 4. Participants' answers regarding dental implant training and education.

Questions		Gs SDSs (n = 150)	Gs NSDSs (n = 150)	Chi (P value)
		n (%)	n (%)	
Do you think there are limitations in funding or supplies to study dental implants?	No	61 (40.7%)	41 (27.3%)	31.3 (<0.001**)
	Yes	89 (59.3%)	109 (72.7%)	
Did you receive training in dental implants during your undergraduate studies at your college?	No	119 (79.3%)	125 (83.3%)	0.79 (0.374)
	Yes	31 (20.7%)	25 (16.7%)	
Which of the following teaching methods were used during the dental implant program in your college?	Lectures	53 (35.3%)	46 (30.7)	9.15 (<0.001**)
	Symposiums	25 (16.7%)	30 (20%)	
	PLT	50 (33.3)	45 (30%)	
	CT	22 (14.7)	29 (19.3%)	
Do you want to participate in workshops and seminars on dental implants?	Yes	119 (79.3%)	112 (74.6%)	11.1 (0.004*)
	No	31 (20.7%)	38 (25.4%)	
Which of the following support did you receive from implant companies for dental implant training during your undergraduate studies?	SM	40 (26.7%)	48 (32%)	7.31 (0.001**)
	IS	46 (30.7%)	38 (25.3%)	
	RC	30 (20%)	32 (21.3%)	
	LTF	25 (16.6%)	24 (16%)	
	CTF	9 (6%)	8 (5.4)	
Did you do dental implant procedures?	Yes	31 (20.7%)	25 (16.7%)	0.79 (0.374)
	No	119 (79.3%)	125 (83.3%)	
Do you want to be a dental implant specialist?	Yes	111 (74%)	95 (63.4%)	9.4 (0.009*)
	NO	39 (26 %)	55 (36.6%)	

Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non Saudi dental PLT: Phantom lab training, CT: Clinical training SM: Simulated models supplying, IS: Implants supplying, RC: Restorative components supplying, LTF: Lab training funding, CTF: Clinical training funding, n: Number. **Highly statistically significant differences, *Statistically significant differences.

There were highly significant differences between the answers to the first, third, fourth, fifth, and seventh questions ($p < 0.001$), while there were no significant differences in the answers to the second and sixth questions ($p > 0.05$).

Regarding participants' information about dental implants (Table 5). In the participants' answers to the first question, 32% of graduates of some Saudi dental schools and 22.7% of graduates of some non-Saudi dental schools said that they obtained their information about dental implants from the internet, while 37.3% of graduates of some Saudi dental schools and 48.7% of graduates of some non-Saudi dental schools said that they do not have accurate information about dental implants. The remaining participants reported that they obtained their

Table 5. Participants' information about dental implants.

Questions		Gs SDSs (n = 150)	Gs NSDSs (n = 150)	Chi (P value)
		n (%)	n (%)	
What is the source of your information about dental implants?	Texts	11 (7.3%)	10 (6.7%)	7.4 (0.385)
	I don't H K	56 (37.3%)	73 (48.7%)	
	Internet	48 (32%)	34 (22.7%)	
	PG	2 (1.3%)	2 (1.3%)	
	SA	9 (6%)	11 (7.3%)	
	Seminars	3 (2%)	4 (2.7%)	
	UG	15 (10%)	8 (5.3%)	
	Workshops	6 (4%)	8 (5.3%)	
Is your information about dental implant sufficient?	No	127 (84.3%)	124 (82.7%)	20.1 (<0.001**)
	Yes	23 (15.3%)	26 (17.3%)	
How many parts are there in a dental implant?	One	21 (14%)	22 (14.7%)	14.6 (0.001**)
	Two	51 (34%)	23 (15.3%)	
	Three	78(52%)	105 (70%)	
What is the most factor for the success of dental implants?	CS	98 (65.3%)	62 (41.3%)	21.8 (0.001**)
	PP	11 (7.3%)	19 (12.7%)	
	T & DIM	12 (8%)	28 (18.7%)	
	Skills of clinician	10 (6.7%)	14 (9.3%)	
	Surgical technique	9 (6%)	6 (4%)	

Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non Saudi dental HK: Have Knowledge, PG: Postgraduate, UG: Undergraduate, T & DIM: Type and material of dental implant. PP: Patient preference, CS: Case selection, SA: Scientific articles/journals, n: Number, **Highly statistically significant differences, *Statistically significant differences.

information about dental implants from texts (7.30% and 6.70%), postgraduate studies (1.30% of all participants), scientific articles/journals (6% and 7.3%), seminars (2% and 2.7%), undergraduate studies (10% and 5.3%) and workshops (4% and 5.3%).

Answers to the second question for most of the participants (84.3% of graduates of some Saudi dental schools and 82.7% of graduates of some non-Saudi dental schools) revealed that the participants' information about dental implants is insufficient, compared to 15.3% and 17.3% of them have sufficient information about dental implants.

Regarding the third question about the number of parts number dental implants, 52% of graduates of some Saudi dental schools and 70% of graduates of

some non-Saudi dental schools chose the correct answer, while the remaining participants chose the wrong answers.

In the answers to the fourth question about the most factor for the success of dental implants, 65.3% of graduates of some Saudi dental schools and 41.3% of graduates of some non-Saudi dental schools answered that case selection is the most factor for the success of dental implants, compared to the remaining of the participants who reported that the type and material of dental implant (8% and 18.7%), the patient preference (7.3% and 12.7%), the skills of the clinician (6.7% and 9.3%) and the surgical technique (6% and 4%) are the most the success factor for dental implants. There were highly significant differences in the answers to all questions ($p < 0.001$), whereas there were no significant differences in the answers to the first question ($p > 0.05$).

Participants' answers to questions about the dental implant retained-restoration are summarized in Table 6. Regarding the answers to the first question, 56.7% of graduates of some Saudi dental schools and 58.7% of graduates of some non-Saudi dental schools answered that they have an idea about dental implant-retained restorations systems, while the remaining reported that they have no idea about dental implant-retained restorations systems.

Regarding the best aesthetic appearance of retained restorations systems (answers to the second question), 54.7% of graduates of some Saudi dental schools and 48.7% of graduates of some non-Saudi dental schools chose cement retained-restoration (CRR), versus 36% and 38% of the participants chose screw retained-restoration (SRR), while the remaining reported that they didn't know.

In the third question answers about fracture resistance, 59.3% of graduates of some Saudi dental schools and 72.7% of graduates of some non-Saudi dental schools showed predilection to use screw-retained restoration (SRR), compared to 40.7% and 27.3% of participants showed predilection to use cement-retained restoration (CRR). In the fourth question about the factor influencing the selection of implant-retained restorations, 22.7% of graduates of some Saudi dental schools and 21.3% of graduates of some non-Saudi dental schools reported that aesthetics is the factor influencing to choice of implant-retained restorations. The remaining answers of participants varied, where some of the participants chose soft tissue health (20% and 20.7%), cost-effectiveness (11.3% and 13.3%), retention (13.3% and 14%), ease of fabrication (16% and 14.7%) and the expertise required are important factors influencing the selection of implant-retained restorations.

In the answers to the fifth question, 62.7% of graduates of some Saudi dental schools and 68.7% of graduates of some non-Saudi dental schools reported that screw-retained restoration is desirable when implant retention is most needed. In contrast, 37.3% and 31.3% of participants reported that cement-retained restoration is desired when implant retention is required most.

In the answers to the sixth question about controlling complications of peri-implant diseases, 47.3% of graduates of some Saudi dental schools and 56% of

Table 6. Participants' answers to questions about the dental implant retained-restoration.

Questions		Gs SDSs	Gs NSDSs	Chi (P value)
		n (%)	n (%)	
Do you have an idea of retained restorative systems in dental implants?	Yes	85 (56.7%)	88 (58.7%)	0.123 (0.726)
	No	65 (43.3%)	62 (41.3%)	
What are the best aesthetically retained restorations in dental implants?	SRR	54 (36%)	57 (38%)	8.4 (0.015*)
	CRR	82 (54.7%)	73 (48.7%)	
	I don't know	14 (9.3%)	20 (13.3%)	
When the fracture resistance of an implant is necessary, which of the following retained restorations will be used?	SRR	89 (59.3%)	109 (72.7%)	31.3 (<0.001**)
	CRR	61 (40.7%)	41 (27.3%)	
Which of the following is an important factor influencing the choice of implant-retaining restorations?	Aesthetics	34 (22.7%)	32 (21.3%)	0.54 (0.462)
	STH	30 (20%)	31 (20.7%)	
	CE	17 (11.3%)	20 (13.3%)	
	Retention	20 (13.3%)	21 (14%)	
	EF	24 (16%)	22 (14.7%)	
	RE	25 (16.7%)	24 (16%)	
When implant retention is most required, what retained restoration is desirable?	SRR	94 (62.7%)	103 (68.7%)	29.6 (<0.001**)
	CRR	56 (37.3%)	47 (31.3%)	
If we want to control the complications of peri-implant diseases, which of the following retained restoration should be used?	SRR	71 (47.3%)	84 (56%)	14.2 (0.001**)
	CRR	79 (52.7%)	66 (44%)	
Which of the following implant-retained restoration is preferred, when ease of fabrication is important?	SRR	67 (44.7%)	41 (27.3%)	9.8 (0.002*)
	CRR	83 (55.3%)	109 (72.7%)	

Gs SDSs: Graduates of some Saudi dental schools, Gs NSDSs: Graduates of some non Saudi dental STH: Soft tissue health, CE: Cost-effectiveness, EF: Ease of Fabrication, RE: Required Expertise, CRR: Cement retained restoration, SRR: Screw retained restoration, n: Number, **Highly statistically significant differences, *statistically significant differences.

graduates of some non-Saudi dental schools chose screw-retained restoration, while the remaining chose cement-retained restoration. On the other hand, In the answers to the seventh question about the importance of ease of fabrication, 55.3% of graduates of some Saudi dental schools and 72.7% of graduates of some non-Saudi dental schools preferred cement-retained restoration, while the remaining preferred screw-retained restoration.

There are statistically significant differences in answers to the second question ($p < 0.05$) and highly significant differences in the third, fifth, sixth, and seventh

questions answers ($p < 0.001$), while there were no statistically significant differences in the first and fourth questions answers ($p > 0.05$).

After evaluating the answers to the questions on the questionnaire parts of the current study, there was a significant correlation between the participants' answers and the participants' graduation schools. The participants' general Knowledge, training, and teaching of dental implants, as well as retained restoration of the dental implant, were higher among graduates of some Saudi dental schools, as compared to graduates of some non-Saudi dental schools, while information about dental implants was higher among graduates of some non-Saudi dental schools, as compared to graduates of some Saudi dental schools.

Table 7 shows the frequency of correct and wrong participants' answers about actual practical attitudes toward dental implants. There was an increase in the frequency of wrong answers more than correct answers without statistically

Table 7. Frequency of participants' correct and incorrect answers regarding actual practical attitude towards dental implants.

Some information from the participants about dental implants	Correct	Incorrect
	n (%)	n (%)
The space between two implants during the surgical procedure.	179 (59.7%)	121 (40.3%)
The distance between the dental implant and natural teeth during the surgical procedure.	108 (36%)	192 (64%)
The distance between the dental implant and the maxillary sinus during the surgical procedure.	150 (50%)	150 (50%)
The number of parts in a dental implant.	183 (61%)	117 (39%)
The most important factor for the success of dental implants.	160 (53.3%)	140 (46.7%)
The best aesthetically retained restorations in dental implants.	139 (46.3%)	161 (53.7%)
The retained restorations for fracture resistance in dental implant.	102 (34%)	198 (66%)
The main factor in selecting retained restorations in dental implants.	65 (21.7%)	235 (78.3%)
The retained restorations to retain the implant.	159 (53%)	141 (47%)
The retained restorations to control complications of peri-implant diseases.	111 (37%)	189 (63%)
The easy fabrication retained restorations in dental implants.	192 (64%)	108 (36%)
Chi-square test		
The average	141 (46.9%)	159 (53.1)
Chi (P value)	0.369 (0.252)	

n: Number.

significant differences ($p > 0.05$).

4. Discussion

The dental implant procedure is an elective treatment method, and patients depend on dentists to give them details about this procedure and other treatment options to make the right decision, as several studies revealed that dentists represent the source for their patients about dental implants information [29] [30]. Thus, assessing the knowledge and actual practical attitude of senior dental students and general dentists plays an essential role in determining whether they can help their patients. To our knowledge, there is a lack of studies conducted in the college of dentistry at King Khalid University and the faculty of dentistry at Sana'a University to assess the practice and understanding of undergraduate students and dentists who graduated from Saudi dental schools as well as non-Saudi dental schools towards dental implants.

Furthermore, seniors dental students and general dentists represent the future dental specialists providing oral and dental treatment, therefore should be adequately educated regarding dental implants. This study aimed to assess the practice and knowledge of dental implants among senior dental students and general dentists who graduated from Saudi dental schools and non-Saudi dental schools less than five ago and more than five years ago .Several studies have evaluated levels of knowledge and attitudes about dental implants among dental students and dentists as in a previous study in Nepal, 67.14% of the participants revealed that they had received enough knowledge about dental implants during their undergraduate studies [31] [32].

In the 1990s, the American Association of Dental Schools determined guidelines for undergraduate training in implant dentistry of curriculum. Thus, the implant theory and clinical training in undergraduate dental studies should be increased [33]. The results of the current study confirmed this need, where 84.3% of graduates of some Saudi dental schools and 82.7% of graduates of some non-Saudi dental schools reported that they did not obtain sufficient information about dental implants during their undergraduate studies. These findings are consistent with the results of another study which revealed that about 40% of the participants reported that they did not receive sufficient information about dental implants during their undergraduate education [34].

An American study reported that 84% of students completed an implant dentistry course as undergraduate training [35]. In contrast with the results of the current study, it was revealed that 79.3% of graduates of some Saudi dental schools and 83.3% of graduates of some non-Saudi dental schools in this study reported that they did not take dental implants training during their undergraduate studies except dental implants lectures in some courses. These results agree with the results of another Saudi study that displayed that most students (78.8%) did not obtain enough lectures and training about dental implants during undergraduate studies [26]. Therefore, the dental implant should be involved in the

undergraduate curriculum as an essential part, and revision curriculums in these dental schools by the current standards of dental education in Europe and America [27] [36].

On the other hand, more than half of the participants in this study (65.3% of graduates of some Saudi dental schools and 41.3% of some non-Saudi dental schools) also reported that case selection is the most significant standard for the success of dental implants procedure which is lower than those participants revealed in a previous Saudi study [37].

Another Saudi survey of five dental schools revealed that in only one school, the students should be finished dental implant cases as a compulsory requirement in the fourth or fifth year [1]. These results are similar to the results in the present study, where 20.7% of graduates of some Saudi dental schools and 16.7% of graduates of some non-Saudi dental schools reported that they carried out implant procedures. Furthermore, no preclinical training in dental implants was offered in the dental schools surveyed, except one school that conducted workshops for students [1]. These results are Identical to the results of this study, where only 4% and 5.3% of participants reported that they attended workshops. All these results confirm the need for more preclinical and clinical training in the dental implant for undergraduate students [28] [38] [39].

In the present study, regarding the best aesthetic appearance 54.7% of graduates of some Saudi dental schools and 48.7% of graduates of some non-Saudi dental schools chose cement retained-restoration (CRR) more than screw retained-restoration (SRR). These results agree with the results of another study exhibited that the senior dental students considered CRR to be superior to SRR with regards to aesthetics [34]. Moreover, most of the participants in this study (59.3% of graduates of some Saudi dental schools and 72.7% of graduates of some non-Saudi dental schools) showed a predilection to use screw-retained restoration (SRR) as fracture resistance more than cement retained-restoration (CRR). These results correspond with standards of dental implants regarding aesthetics due to the possibility of the presence of a screw access hole in screw-retained restoration (SRR) if the positioning of dental implants improperly and are not corresponding with standards of dental implants regarding the resistance of fracture due to presence of unsupported ceramic in SRR, resulting in an increased fractures incidence [15] [20] [40].

On the other hand, newly graduated dentists in another study said that they want to provide dental implant treatment to their patients, similar to the current study, where more than half of the participants confirmed that they want to be specialists in dental implants (74% and 63.4%) [38].

Furthermore, In the present study, there were significant differences between CRR and SRR in graduates of some Saudi dental schools and graduates of some non-Saudi dental schools answers where the correct answers included the preponderance of CRR on SRR except for the third question and fifth question answers where SRR preponderance on CRR among graduates of some Saudi dental schools more than graduates of some non-Saudi dental schools except the se-

venth question answers where the correct answers included the preponderance of CRR on SRR among graduates of some non-Saudi dental schools more than graduates of some Saudi dental schools. These results are dissimilar to the other studies' results which found that there were slight or insignificant significant differences between CRR and SRR in the participants' answers [41].

The significant result in this study was that 50% of graduates of some Saudi dental schools and 71.3% of some non-Saudi dental schools did not have any experience in dental implants, which may be due to the lack of clinical training in dental implants for students during the undergraduate teaching [35].

The present study was a survey study, so it may not reflect the updated curriculum in dental schools surveyed in the current study. But it revealed a defect in the curricula of dental schools surveyed in teaching dental implants due to the lack of clear guidelines for curricula as well as differences in teaching methods applied in these schools. Thus, curriculum guidelines and teaching methods applied in these schools should be the same, in addition to providing an adequate faculty-to-student ratio for dental implant teaching.

5. Conclusion

There is a need for more academic teaching and laboratory as well as clinical training in dental implants for senior dental students and the general dentists who graduated from dental schools surveyed in the current study by offering the lowest mandatory clinical requirements for the cases that students must attend during the undergraduate studies. Moreover, adding more information about dental implants into the curricula of dental schools surveyed.

6. Strength and Limitations

The results of this study may help policymakers and program directors in different institutions in Saudi Arabia and the Republic of Yemen to identify points of improvement in teaching dental implants to undergraduate students. There were limitations during the current study, including the low number of dental schools surveyed in limited areas, in addition to the difficulties during data collections. Therefore, there is a need for an increase in the number of dental schools surveyed and the sample size in more regions to popularize the results.

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Conflicts of Interest

There is no conflict of interest.

References

[1] Al Kindi, M., Ramalingam, S., Abuhaimed, A. and Alkharan, H. (2018) Undergra-

duate Implant Dentistry Training in Saudi Dental Schools. *Journal of Ayub Medical College Abbottabad*, **30**, 217-222.

[2] Young, M.P., Carter, D.H., Sloan, P. and Quayle, A.A. (1999) A Survey of Oral Implantology Teaching in the University Dental Hospitals and Schools of the United Kingdom and Eire. *British Dental Journal*, **187**, 671-675. https://doi.org/10.1038/sj.bdj.4800364

[3] Brunski, J.B. (1999) In Vivo Bone Response to Biomechanical Loading at the Bone/Dental-Implant Interface. *Advances in Dental Research*, **13**, 99-119. https://doi.org/10.1177/08959374990130012301

[4] Feine, J.S., Carlsson, G.E., Awad, M.A., *et al*. (2002) The McGill Consensus Statement on Overdentures, Montreal, Quebec, Canada, May 24-25, 2002. *International Journal of Prosthodontics*, **15**, 413-414.

[5] Wang, H.-L., Shotwell, J.L., Itose, T. and Neiva, R.F. (2005) Multidisciplinary Treatment Approach for Enhancement of Implant Esthetics. *Implant Dentistry*, **14**, 21-29. https://doi.org/10.1097/01.id.0000154802.20125.b9

[6] Palmer, R. (1999) Introduction to Dental Implants. *British Dental Journal*, **187**, 127-132. https://doi.org/10.1038/sj.bdj.4800222a

[7] Zarb, G.A. (1983) The Edentulous Milieu. *Journal of Prosthetic Dentistry*, **49**, 825-831. https://doi.org/10.1016/0022-3913(83)90358-X

[8] Jivraj, S. and Chee, W. (2006) Rationale for Dental Implants. *British Dental Journal*, **200**, 661-665. https://doi.org/10.1038/sj.bdj.4813718

[9] Tsirlis, A. (2005) Clinical Evaluation of Immediate Loaded Upper Anterior Single Implants. *Implant Dentistry*, **14**, 94-103. https://doi.org/10.1097/01.id.0000156386.27897.7d

[10] Derks, J., Schaller, D., Håkansson, J., Wennström, J.L., Tomasi, C. and Berglundh, T. (2016) Effectiveness of Implant Therapy Analyzed in a Swedish Population: Prevalence of Peri-Implantitis. *Journal of Dental Research*, **95**, 43-49. https://doi.org/10.1177/0022034515608832

[11] Geckili, O., Bilhan, H., Geckili, E., Cilingir, A., Mumcu, E. and Bural, C. (2014) Evaluation of Possible Prognostic Factors for the Success, Survival, and Failure of Dental Implants. *Implant Dentistry*, **23**, 44-50. https://doi.org/10.1097/ID.0b013e3182a5d430

[12] Vohra, F., Al-Rifaiy, M.Q., Almas, K. and Javed, F. (2014) Efficacy of Systemic Bisphosphonate Delivery on Osseointegration of Implants under Osteoporotic Conditions: Lessons from Animal Studies. *Archives of Oral Biology*, **59**, 912-920. https://doi.org/10.1016/j.archoralbio.2014.05.016

[13] Diz, P., Scully, C. and Sanz, M. (2013) Dental Implants in the Medically Compromised Patient. *Journal of Dentistry*, **41**, 195-206. https://doi.org/10.1016/j.jdent.2012.12.008

[14] da Rocha, P.V.B., Freitas, M.A. and de Morais Alves da Cunha, T. (2013) Influence of Screw Access on the Retention of Cementretained Implant Prostheses. *The Journal of Prosthetic Dentistry*, **109**, 264-268. https://doi.org/10.1016/S0022-3913(13)60055-4

[15] Michalakis, K.X., Hirayama, H. and Garefis, P.D. (2003) Cement-Retained Versus-screw-Retained Implant Restorations: A Critical Review. *International Journal of Oral & Maxillofacial Implants*, **18**, 719-728.

[16] Korsch, M., Obst, U. and Walther, W. (2014) Cement-Associated Peri-Implantitis: A Retrospective Clinical Observational Study of Fixed Implant-Supported Restora-

tions Using a Methacrylate Cement. *Clinical Oral Implants Research*, **25**, 797-802. https://doi.org/10.1111/clr.12173

[17] Hebel, K.S. and Gajjar, R.C. (1997) Cement-Retained versus Screw-Retained Implant Restorations: Achieving Optimal Occlusion and Esthetics in Implant Dentistry. *Journal of Prosthetic Dentistry*, **77**, 28-35. https://doi.org/10.1016/S0022-3913(97)70203-8

[18] Pietrabissa, R., Gionso, L., Quaglini, V., Di Martino, E. and Simion, M. (2000) An *in Vitro* Study on Compensation of Mismatch of Screw versus Cement-Retained Implant Supported Fixed Prostheses. *Clinical Oral Implants Research*, **11**, 448-457. https://doi.org/10.1034/j.1600-0501.2000.011005448.x

[19] McGlumphy, E.A., Mendel, D.A. and Holloway, J.A. (1998) Implant Screw Mechanics. *Dental Clinics of North America*, **42**, 71-89. https://doi.org/10.1016/S0011-8532(22)00606-1

[20] Zarone, F., Sorrentino, R., Traini, T., Di lorio, D. and Caputi, S. (2007) Fracture Resistance of Implant-Supported Screw-versus Cement-Retained Porcelain Fused to Metal Single Crowns: SEM Fractographic Analysis. *Dental Materials*, **23**, 296-301. https://doi.org/10.1016/j.dental.2005.10.013

[21] Misch, C.E. (1995) Screw-Retained versus Cement-Retained Implant-Supported Prostheses. *Practical Periodontics and Aesthetic Dentistry*, **7**, 15-18.

[22] Guichet, D.L., Caputo, A.A., Choi, H. and Sorensen, J.A. (2000) Passivity of Fit and Marginal Opening in Screw-or Cement-Retained Implant Fixed Partial Denture Designs. *International Journal of Oral & Maxillofacial Implants*, **15**, 239-246.

[23] Taylor, T.D. and Agar, J.R. (2002) Twenty Years of Progress in Implant Prosthodontics. *Journal of Prosthetic Dentistry*, **88**, 89-95. https://doi.org/10.1067/mpr.2002.126818

[24] Chee, W.W., Duncan, J., Afshar, M. and Moshaverinia, A. (2013) Evaluation of the Amount of Excess Cement around the Margins of Cement-Retained Dental Implant Restorations: The Effect of the Cement Application Method. *Journal of Prosthetic Dentistry*, **109**, 216-221. https://doi.org/10.1016/S0022-3913(13)60047-5

[25] Agar, J.R., Cameron, S.M., Hughbanks, J.C. and Parker, M.H. (1997) Cement Removal from Restorations Luted to Titanium Abutments with Simulated Subgingival Margins. *Journal of Prosthetic Dentistry*, **78**, 43-47. https://doi.org/10.1016/S0022-3913(97)70086-6

[26] Aljohani, H.A. and Alghamdi, A.S.T. (2009) Predoctoral Dental Implant Education at King Abdulaziz University. *The Saudi Dental Journal*, **21**, 135-138. https://doi.org/10.1016/j.sdentj.2009.10.005

[27] Lim, M.V., Afsharzand, Z., Rashedi, B. and Petropoulos, V.C. (2005) Predoctoral Implant Education in U.S. Dental Schools. *Journal of Prosthodontics*, **14**, 46-56. https://doi.org/10.1111/j.1532-849X.2004.04047.x

[28] Atashrazm, P., Vallaie, N., Rahnema, R., Ansari, H. and Shahab, M.P. (2011) Worldwide Predoctoral Dental Implant Curriculum Survey. *Journal of Dentistry of Tehran University of Medical Sciences*, **8**, 12-18.

[29] Sharma, A., Shrestha, B., Chaudhari, B.K., Suwal, P. and Singh, R.K. (2018) Knowledge, Awareness, and Attitude Regarding Dental Implants among Dental Interns. *Journal of Nepal Medical Association*, **56**, 607-615. https://doi.org/10.31729/jnma.3440

[30] Vohra, F. and Habib, R. (2015) Knowledge and Attitude of Dentists toward Implant Retained Restorations in Saudi Arabia. *Nigerian Journal of Clinical Practice*, **18**, 312-317. https://doi.org/10.4103/1119-3077.151788

[31] Dhami, B., Shrestha, P., Lamichhane, B., Sharma, A.K. and Gupta, S. (2017) Dental Implants and General Dental Practitioners of Nepal: A Study of Existing Knowledge and Need for Further Education. *Journal of College of Medical Sciences-Nepal*, **13**, 212-215. https://doi.org/10.3126/jcmsn.v13i1.16668

[32] Nagpal, D., Prakash, S., Kalra, D.D. and Singh, G. (2018) Knowledge, Attitude, and Practice of Dental Implants among Dental Postgraduates and Practitioners in Davangere City, Karnataka: A Cross-Sectional Study. *Indian Journal of Dental Research*, **29**, 575-582. https://doi.org/10.4103/ijdr.IJDR_500_15

[33] Slavkin, H.C. (1998) Science, Technology and Health Literacy for the 21st Century: A Future for Dentistry. *New York State Dental Journal*, **64**, 25-28.

[34] Vohra, F., Shah, A.H., Zafar, M.S. and Kola, Z. (2015) Knowledge and Practice of Implant-Retained Restorations among Dental Students in Saudi Arabia. *Pakistan Journal of Medical Sciences*, **31**, 848-853. https://doi.org/10.12669/pjms.314.7384

[35] Petropoulos, V.C., Arbree, N.S., Tarnow, D., Rethman, M., Malmquist, J., Valachovic, R., *et al*. (2006) Teaching implant Dentistry in the Predoctoral Curriculum: A Report from the ADEA Implant Workshop's Survey of Deans. *Journal of Dental Education*, **70**, 580-588. https://doi.org/10.1002/j.0022-0337.2006.70.5.tb04114.x

[36] Mattheos, N., Albrektsson, T., Buser, D., De Bruyn, H., Donos, N., Hjorting Hansen, E., *et al*. (2009) Teaching and Assessment of Implant Dentistry in Undergraduate and Postgraduate Education: A European Consensus. *European Journal of Dental Education*, **13**, 11-17. https://doi.org/10.1111/j.1600-0579.2008.00556.x

[37] Alghamdi, M., Aboalshamat, K., Alghamdi, D., Abed, S., Almahlawi, H., AlKathiri, S., Abu Thiraa, A., Alsulami, A. and Alzughaibi, M. (2020) Knowledge and Attitudes of Dental Interns and Dentists on Implants and Implant-Retained Restorations in Jeddah, Saudi Arabia. *The Open Dentistry Journal*, **14**, 329-336 https://doi.org/10.2174/1874210602014010329

[38] Maalhagh-Fard, A., Nimmo, A., Lepczyk, J.W. and Pink, F.E. (2002) Implant Dentistry in Predoctoral Education: The Elective Approach. *Journal of Prosthodontics*, **11**, 202-207. https://doi.org/10.1053/jopr.2002.126726

[39] Afsharzand, Z., Lim, M.V., Rashedi, B. and Petropoulos, V.C. (2005) Predoctoral Implant Dentistry Curriculum Survey: European Dental Schools. *European Journal of Dental Education*, **9**, 37-45. https://doi.org/10.1111/j.1600-0579.2004.00363.x

[40] Chee, W., Felton, D.A., Johnson, P.F. and Sullivan, D.Y. (1999) Cemented versus Screw-Retained Implant Prostheses: Which Is Better? *International Journal of Oral & Maxillofacial Implants*, **14**, 137-141.

[41] Heckmann, S.M., Karl, M., Wichmann, M.G., Winter, W., Graef, F. and Taylor, T.D. (2004) Cement Fixation and Screw Retention: Parameters of Passive Fit: An *in Vitro* Study of Three-Unit Implant-Supported Fixed Partial Dentures. *Clinical Oral Implants Research*, **15**, 466-473. https://doi.org/10.1111/j.1600-0501.2004.01027.x