



The Knowledge and Practices of the Absolute and Relative Dental Implant Contraindications of General Dental Practitioners in Riyadh, Saudi Arabia

Khansa Taha Ababneh^{1,2,3} Fathima Fazrina Farook^{1,2,3} Tala Al Kharashi^{1,2,3,4} Samar Al Arfaj^{1,2,3,5}
Renad Allahim^{1,2,3,6}

¹Preventive Dental Science Department, College of Dentistry, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

²King Abdullah International Medical Research Center, Riyadh, Saudi Arabia

³Ministry of the National Guard - Health Affairs, Riyadh, Saudi Arabia

⁴College of Public Health and Health Informatics, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

⁵Oral Medicine and Diagnostic Science Department, Oral and Maxillofacial Radiology Division, College of Dentistry, King Saud University, Riyadh, Saudi Arabia

⁶Periodontics Resident, Dental University Hospital, King Saud University, Riyadh, Saudi Arabia

Address for correspondence Khansa Taha Ababneh, BDS, PhD, FDSRCS, Preventive Dental Science Department, College of Dentistry, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia. King Abdullah International Medical Research Centre, Ali Al Arini, Riyadh, 14612, Saudi Arabia (e-mail: ktbabneh@hotmail.com).

Eur J Gen Dent 2023;12:48–55.

Abstract

Objectives General dental practitioners (GDPs) are faced with increasing numbers of patients requesting dental implants (DI) to replace missing teeth. Being the first dental professional consulting with the patient, being knowledgeable about DI contraindications (DIC) would support the development of appropriate treatment plans. This study aimed to investigate the GDPs level of knowledge of a number of DICs. The study was done in Riyadh, KSA.

Materials and Methods A structured electronic questionnaire was distributed to GDPs who consented to participate. Participants were asked whether certain systemic and local conditions were considered DIC, and whether such DIC were considered absolute or relative. Descriptive statistics, *t*-tests, or one-way analysis of variance, and multiple linear regression were used for the statistical analysis ($p \leq 0.05$) to assess the association between the sample characteristics and knowledge of DICs.

Results Less than half (42%) of the respondents scored 25 to 50%, and only 2% scored 75 to 100%. The highest proportion of correct responses was related to questions regarding old age (74.09%), glycemic categories (68.52%), active chemotherapy (64.07%), and intravenous bisphosphonates (49.86%). The responses were significantly associated with the years of experience, place of graduation, and highest qualification in DI. Based on the linear regression analysis, higher years of practice were associated with less knowledge of DIC (inverse relationship), graduates of Saudi governmental

Keywords

- ▶ dental implants
- ▶ contraindications
- ▶ absolute
- ▶ relative
- ▶ general dental practitioners

universities scored higher than the other groups of graduates, and holders of a master's degree in DI scored higher compared to holders of other qualifications. In addition, respondents who received lectures and/or laboratory training as part of their undergraduate curriculum had higher scores than the group who did not.

Conclusion The level of DIC-related knowledge of the GDPs in Riyadh is generally good but incomplete; it is significantly influenced by the GDPs' years of practice, place of graduation, qualifications, and receiving didactic and laboratory training in the undergraduate programs. More emphasis on DI and DIC is required to improve treatment planning and patient referral.

Introduction

Dental implants (DI) have progressively become a vital treatment option to replace missing teeth.¹ A study conducted in the Kingdom of Saudi Arabia (KSA) in 2010 reported that the majority of the dental patients (61.5%) believed that DI were the most effective treatment option for replacing missing teeth.² Another study revealed that 67% of the dental patients in Riyadh were willing to pay the median price for the placement of an implant. There has been an increasing demand for DI therapy in recent years, resulting to an increased implant practice in Saudi Arabia.^{3,4} A study in Riyadh indicated that 48.1% of the GDPs who practice implant placement were general dental practitioners (GDPs), 30.8% periodontists, 11.9% oral surgeons, and 3.8% restorative specialists.⁴ Most of the GDPs in that study acquired DI related knowledge during their undergraduate studies, or by attending courses and/or seminars.⁴ A recent study reported that only three of five schools in KSA had DI laboratory sessions and most dental students in KSA learn implant dentistry in the form of multidisciplinary sessions from different courses and departments.⁵

Failure to recognize dental implant contraindications (DICs) may lead to complications and implant failure.⁶ DICs have been classified in various categories.⁶ One category is classifying DIC into local, behavioral/environmental, and medical,⁷ or to describe DIC as local or general.⁸ However, DICs are currently classified into relative and absolute.^{6,9} Implant failure may arise from impaired host healing, disruption of a weak bone-to-implant interface after abutment connection, and infection.⁹ Absolute contraindications are those which, if not taken into consideration, may result in patient mortality or jaw bone necrosis and implant failure.⁶ They include cerebrovascular accident, immunosuppression, active treatment of malignancy, certain categories of psychiatric illness, intravenous bisphosphonate use, and other critical medical conditions.⁶ Relative contraindications interfere with normal cell healing and remodeling, but once controlled, implant surgery and survival will succeed.⁹ Examples of relative contraindications include, but not limited to, adolescence, aging, smoking, diabetes, human immunodeficiency virus positivity, and hypothyroidism.⁹ Local contraindications, or local risk factors, are relative to the site of implant placement and can be modified by corrective

procedures.¹⁰ These include insufficient alveolar bone density or volume, insufficient soft tissue quality and/or quantity, unfavorable position near anatomical structures, poor oral hygiene, periodontal disease, and infection near future implant sites.^{10,11} Adequate knowledge of these contraindications would improve patient management. To date, there is a lack of studies in KSA and globally, regarding GDPs' knowledge of DIC. This study aimed to evaluate the knowledge and practices related to DIC in GDPs in Riyadh, KSA.

Materials and Methods

This cross-sectional study was conducted at various governmental and private dental hospitals and polyclinics in Riyadh. Ethical approval (NRC21R/065/03) was obtained from King Abdullah International Medical Research Center. The data was collected by distributing a self-administered electronic or paper-based questionnaire to the GDPs practicing in the Riyadh region from November 2020 to July 2021. Informed consent was obtained from all eligible and interested participants prior to participation.

Study Population and Sample Size

The sample size was calculated using the single proportion formula based on 95% confidence level, expected proportion of 50%,¹² precision of 0.05, and a 10% drop out rate. The recommended sample size was 359 GDPs from a population of 5211. The sample size calculation was performed using the PASS 2020, v20.0.3 software. A convenient sampling technique was used to identify the sample and only dental practitioners working in Riyadh region were included in the study. Participants with incomplete questionnaires, as well as specialist dentists were excluded.

Questionnaire

The questionnaire was evaluated for face and content validity, feasibility, and construct validity. As a whole, this instrument had a good level of reliability (Cronbach's coefficient alpha = 0.73). The electronic questionnaire consisted of three main sections. The first section focused on the demographic and background information of the participants, the second section the participants' DI training and practice, and the last section items regarding the participants' knowledge regarding a number of relative and absolute DIC. The

questionnaire was developed with <https://docs.google.com/forms>, and was distributed through social media platforms such as Twitter and WhatsApp applications from Apple store.

Classification of Risk Factors in the Survey

► **Table 1** presents a list of the risk factors and contraindications. The participants were asked to specify whether each of the listed risk factors is considered a contraindication, and if so, what type of contraindication it is, that is, relative or absolute,^{6,9} the classification followed in the present study. Whether a response was correct or incorrect was based on multiple reports in literature (► **Table 1**).^{1,7-11} The scoring system consisted of 1 for a correct response, and 0 for an incorrect response. The individual scores were summed to yield a total score for each participant.

Statistical Analysis

The data were entered in an Excel spreadsheet and analyzed using NCSS version 2020. Univariate analyses were used to summarize the sample characteristics (► **Table 2**). *t*-tests or one-way analysis of variance were used to assess the association between the sample characteristics and the knowledge of DIC (► **Table 3**). A multiple linear regression analysis was used to determine the independent predictors of knowledge related to ICI. All variables with a *p*-value less than 0.2 in the univariate analysis were included in the multivariate analy-

sis. Multicollinearity was ruled out by applying standard procedures. A stepwise selection procedure was used to optimize the model's fit and to determine the variance in the knowledge accounted for by each correlate (► **Table 4**). The results of the multiple regression analyses include both the regression coefficient and the standardized regression coefficient. Statistical significance was assumed at *p*-value less than 0.05.

Limitations of the Study

The main limitation of this study was the low rate of response to the survey, and the unwillingness of many GDPs to answer the questionnaire, which necessitated a longer time and effort than originally planned. The reason for this may be partly the high number of online studies that requested all types of study populations to answer online questionnaires during the coronavirus disease-19 pandemic, with resultant low compliance by potential participants.

Results

Characteristics of the Study Population

► **Table 2** demonstrates the characteristics of the study population. The majority (52%) were male, 26 to 35 years old, had less than 5 years of work experience, worked in private noneducational institutions, and graduated from national government universities.

Table 1 Risk factors and correct classification of answers

Risk Factors		Contraindication
Active chemotherapy		Systemic absolute
Active head and neck radiotherapy		Systemic absolute
Previous head and neck radiotherapy		Systemic relative
Osteoporosis		Systemic relative
Tobacco smoking		Systemic absolute Local absolute
Psychiatric illness		Systemic relative
Intravenous bisphosphonates therapy		Systemic absolute Systemic relative
Oral bisphosphonate therapy		Systemic relative
Hypothyroidism		Systemic relative
Insufficient alveolar bone density or dimensions		Local relative
Poor oral hygiene		Local absolute
Categories of glycated hemoglobin (HbA1C)	< 6	Not a contraindication
	7-9	Systemic absolute
	> 9	Systemic absolute
Old age (> 65)		Not a contraindication
Age less than 18 years		Systemic absolute
Consensus regarding the placement of implants in the prepubertal age		Not contraindicated in special situations (e.g., ectodermal dysplasia)
Neuromuscular diseases		Systemic relative

Abbreviation: HbA1C, hemoglobin A1c.

Table 2 Characteristics of the study population

Variables	Number (%)
Gender	
Male	172 (52.09)
Female	187 (47.91)
Age (years)	
≤ 25	109 (30.36)
26–35	198 (55.15)
36–45	38 (10.58)
46–55	10(2.79)
> 55	4 (1.11)
Years of experience	
< 5 years	262 (72.98)
5–10 years	57 (15.88)
11–15	18 (5.01)
> 15	22 (6.13)
Work place	
Private sector (<i>noneducational</i>)	175 (48.75)
Government sector (<i>noneducational</i>)	77 (21.45)
Educational Institution (<i>private or governmental</i>)	83 (23.12)
Unemployed	24 (6.69)
Place of graduation (university)	
National government	207 (57.66)
National private	81 (22.56)
International government	32 (8.91)
International private	39 (10.86)

Participants Responses Based on their Characteristics

► **Table 3** displays the relationship between the mean and standard deviation of the scores achieved and respondents' characteristics. There was a significant difference in the respondents' level of DIC-related knowledge, based on the years of experience, place of graduation, highest qualification in DI, and the type of undergraduate training received in DI ($p < 0.05$). There were no significant differences in terms of gender, number of implants placed, part of implant treatment performed, reporting following of DIC guidelines, DI training received after graduation, and the length of that training program (► **Table 3**).

Percentage of Participants Responding Correctly

The highest proportion of the respondents (41.5%) responded correctly to 25 to 50% of the questions, 30.36% responded correctly to 0 to 25% of the questions, 25.91% of the participants responded to 50 to 75% correctly, and 2.23% responded correctly to 75 to 100% of the questions.

Respondents' Answers

The frequency of correct and incorrect responses to each item is presented in ► **Fig. 1** (bar chart). The chart demonstrates that the highest proportion of correct responses was related to old age (74.09%), followed by glycemic categories (68.52%), active chemotherapy (64.07%), and intravenous (IV) bisphosphonates (49.86%).

Stepwise Multiple Linear Regression Analysis

The multiple stepwise linear regression selected three factors that were independently associated with the response variable, namely the years of experience, place of graduation, and the highest qualification in DI ($p = 0.046$, $p = 0.000$, and $p = 0.0018$, respectively). There was an inverse relationship

Table 3 Relationship between achieved scores and participant characteristics

Characteristics	Mean score	SD	t/F ^a	p-Value
Gender				
Male	40.33	19.64	-0.75	0.45
Female	38.67	22.18		
Years of experience				
< 5 years	42.44	20.49	7.11	0.0001 ^a
5–10	29.93	19.86		
11–15	35.07	19.66		
> 15	32.38	22.29		
Place of graduation				
National government	45.56	20.87	15.8	<0.001 ^a
National private	32.64	17.62		
International government	30.47	20.68		
International private	28.68	17.25		

(Continued)

Table 3 (Continued)

Characteristics	Mean score	SD	t/F ^a	p-Value
Highest qualification in DI				
No qualification	38.63	21.85	15.84	<0.001 ^a
Certificate	42.56	18.08		
Diploma	34.37	18.36		
Fellowship	22.5	13.69		
Master	64.06	5.98		
Number of DI placed				
None	36.47	21.26	1.98	0.17
Less than 10	39.88	19.41		
10–20	31.25	17.68		
21–30	43.75			
31–40	54.46	11.25		
> 40	37.5			
Part of DI treatment performed				
None	40.13	21.41	0.51	0.68
Surgical part	37.05	20.72		
Prosthetic part	38.67	19.73		
Both surgical and prosthetic part	35.89	19.13		
Undergraduate training				
Lectures			47.4	<0.001 ^a
Yes	55.33	19.19		
No	36.22	19.85		
Laboratory			62.87	<0.001 ^a
Yes	55.25	15.91		
No	35.29	20.19		
None			60.03	<0.001 ^a
Yes	27.18	18.33		
No	44.61	19.88		
Training after graduation				
Lectures			1.66	0.22
Yes	38.32	22.66		
No	48.11	18.26		
Hands on models/animal			0.42	0.71
Yes	39.59	21.22		
No	38.10	18.63		
Hands on patients			0.04	0.84
Yes	39.52	21.09		
No	39.54	19.44		
No courses			0.98	0.33
Yes	40.66	18.59		
No	38.50	22.74		
Length of courses			1.84	0.10
1–2	44.38	18.28		
3–7	39.48	18.47		
> 1 month	40.18	19.97		
Following guidelines for contraindications				
Yes	42.02	19.32	1.13	0.32
No	32.21	20.70		
I do not know	39.38	21.24		

Abbreviations: DI, dental implant; SD, standard deviation.

^ap-Values reported were significant based on a significance level of 0.05.

Table 4 Results of the multiple regression analysis with the scores as the outcome variable

	B (SE of B)	β (t-Value)	p-Value
Years of experience			
< 5 years	Ref		
5–10	−7.639 (3.076)	−0.1332 (−2.483)	0.0135
11–15	4.539 (6.091)	0.0473 (0.745)	0.4567
> 15	−1.753 (5.895)	−0.0201 (−0.297)	0.7663
Place of graduation			
National government	Ref		
National private	−12.769 (2.564)	−0.2547 (−4.98)	0.0000
International government	−19.218 (5.448)	−0.2613 (−3.528)	0.0005
International private	−13.593 (3.846)	−0.2018 (−3.534)	0.0005
Highest qualification on implants			
No qualification	Ref		
Certificate	4.064(2.454)	0.0821 (1.65)6	0.0986
Diploma	1.716(5.875)	0.0147 (0.292)	0.7704
Fellowship	−10.958(9.029)	−0.0613 (−1.214)	0.2257
Master	37.627(10.319)	0.1884 (3.647)	0.0003
Constant	45.36		
Adjusted R ²	0.154		
n = 359			

Abbreviation: SE, standard error.

^ap-Values reported were significant based on a significance level of 0.05.

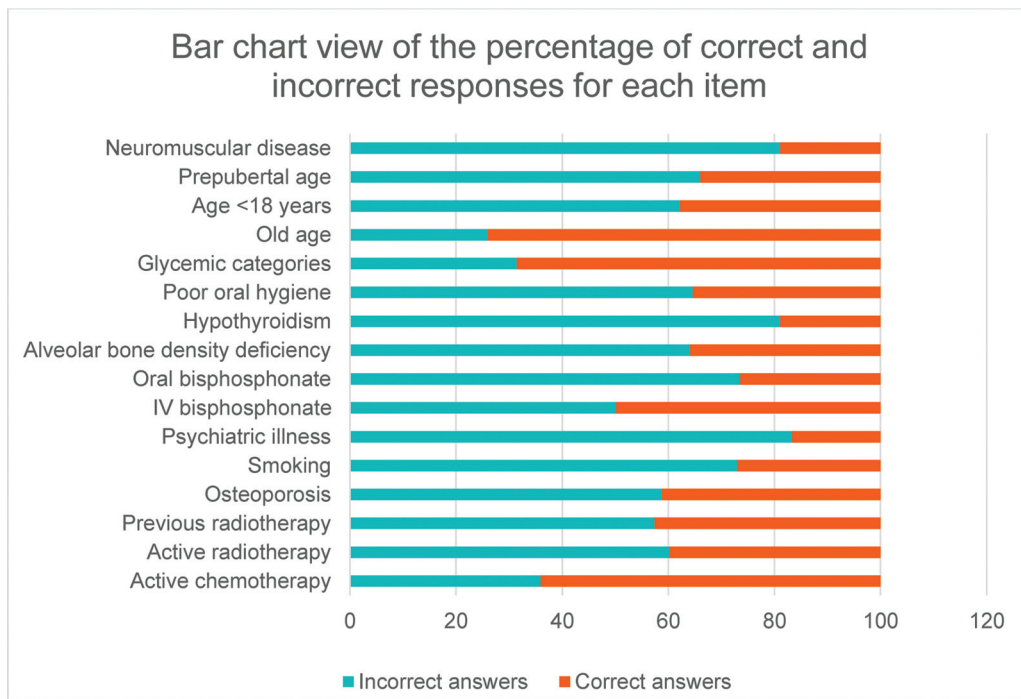


Fig. 1 Bar chart summarizing the correct and incorrect responses for each item.

between the years of experience and knowledge of implant contraindications ($p = 0.013$; ► **Table 4**). The years of experience, place of graduation, and the highest qualification explained 15.4% (R^2) of the variation in the level of DIC knowledge. Concerning the years of experience, there was a 7.64 decrease in knowledge in respondents with 5 to 10 years of experience, compared to respondents with less than 5 years of experience ($p < 0.014$).

Regarding graduation, private university graduates and graduates of international universities had a significant negative weight, compared to the group that graduated from a Saudi government university. After accounting for other potential predictors, the private national, and the international universities groups had lower scores ($p < 0.001$).

With regard to the highest qualification attained in DI, a master's degree holders were most knowledgeable about DIC, compared to the other categories. The difference was significant when compared to the group that had no qualifications in DI ($p < 0.001$). However, the other types of qualifications on DI, such as certificate, diploma, or fellowship did not significantly contribute to the model.

Discussion

With excellent long-term survival and success rates,¹³ DI is becoming an increasingly favored method of tooth replacement, by dental professionals and patients.¹⁴ Accordingly, an increasing number of dentists are encountering patients in need of DI placement. However, undergraduate training alone appears to be inadequate for starting a career in DI.¹⁵ Because knowledge of DIC is of the utmost importance for treatment planning, we investigated the knowledge of GDPs in Riyadh, KSA of a number of DIC. Most of the participants were male, 26 to 35 years old, have recently graduated from national government universities and worked in a private practice. The achieved scores were significantly associated with some of these characteristics, which included the years of experience, place of graduation, and the highest degree obtained in DI. In terms of the years of experience, the multiple regression analysis demonstrated that there was an inverse relationship between the years of experience and knowledge of DIC; there was a 7.64 decrease in the level of knowledge in respondents with 5 to 10 years of experience, compared to respondents with less than 5 years of experience. This is in agreement with the fact that most respondents worked in private clinical practice, who may be too busy for continuous dental education, especially with advancing years of private-practice career, and especially if they were not placing any DI. A cross-sectional web-survey conducted with Australian GDPs,¹⁶ demonstrated that younger GDPs were more likely to start practicing DI shortly after graduation, and that they obtained training by continuous dental education organized by companies or associations.

Regarding the place of graduation, our results indicate that a higher percentage of graduates of Saudi government universities obtained a higher score, compared to the other three categories of graduates. This may indicate that DI

training could have received greater attention in the programs of in the Saudi government dental colleges, than the other universities, although the data from our study is insufficient to make such conclusions. A recent study in KSA¹⁷ reported that Saudi GDPs, interns, and students showed moderate knowledge of DI complications, with the variation in knowledge based on the place of graduation. When the responses were compared in terms of the highest qualification attained in DI, it was observed that holders of a master's degree achieved the highest scores, which is logical taking into consideration the availability of well-structured postgraduate programs in DI, within and outside the Kingdom. Another factor influencing the participants' responses was the type of undergraduate training in DI. Respondents who received lectures and/or laboratory training as part of their undergraduate curriculum achieved higher scores than the group who did not. This is clearly because of the learned material and necessity to pass various examinations and assessment methods in these courses.

Only a minority of the participants (about 2%) were able to respond correctly to 75 to 100 of questions. The majority could only respond correctly to 25 to 50% of the questions. This could be related to differences in the individual knowledge and interest of participants, or it could indicate that DI courses need to be modified to include all topics relevant to DI treatment planning and communication with patients.¹⁷ Of the 16 DIC included in our study, the highest proportion of correct responses was related to old age, glycemic control, active chemotherapy, and IV Bisphosphonates. This is good but inadequate, and more emphasis should be placed on DI in dental colleges, and in continuous education programs.¹⁷ The need for improving GDP-related knowledge and practice of DI was confirmed by a survey in India exploring the knowledge, attitude, and practice towards impression technique and materials as related to DI, in dental practitioners, including specialists, and found that the majority had good knowledge, but fair attitude and practice.¹⁸

Conclusion

The level of the knowledge related to DIC of GDPs in Riyadh is relatively good, but inadequate. Graduates of the Saudi government universities achieved the highest scores. Other factors significantly influencing the scores were the years of experience (inverse relationship), holding a master's degree in DI and having had undergraduate didactic and laboratory training in DI. However, greater emphasis on DI courses during undergraduate studies would favor a comprehensive approach to dental patient management.

Conflict of Interest

None declared.

Acknowledgement

The authors would like to express their sincere thanks to Dr. Susanna Wright of King Abdullah International Medical Research Center, for her assistance in editing the manuscript.

References

- 1 Hicklin SP, Albrektsson T, Hämmerle CH1st European Consensus Workshop in Implant Dentistry University Education. Theoretical knowledge in implant dentistry for undergraduate students. *Eur J Dent Educ* 2009;13(Suppl 1):25–35
- 2 Al-Johany S, Al Zoman HA, Al Juhaini M, Al Refeai M. Dental patients' awareness and knowledge in using dental implants as an option in replacing missing teeth: a survey in Riyadh, Saudi Arabia. *Saudi Dent J* 2010;22(04):183–188
- 3 Al Garni B, Pani SC, Almaaz A, Al Qeshtaini E, Abu-Haimed H, Al Sharif K. Factors affecting the willingness to pay for implants: a study of patients in Riyadh, Saudi Arabia. *Dent Res J (Isfahan)* 2012;9(06):719–724
- 4 Albugami RA, Smith S, Hassan MA, Almas K. Trends in implant dentistry: Implant systems, complications and barriers in Riyadh, Saudi Arabia. *Dent Med Probl* 2019;56(03):223–230
- 5 AlKindi M, Ramalingam S, Abuhaimed A, Alkharan H. Undergraduate implant dentistry training in Saudi Dental schools. *J Ayub Med Coll Abbottabad* 2018;30(02):217–222
- 6 Hwang D, Wang HL. Medical contraindications to implant therapy: part I: absolute contraindications. *Implant Dent* 2006;15(04):353–360
- 7 Oikarinen K, Raustia AM, Hartikainen M. General and local contraindications for endosseal implants—an epidemiological panoramic radiograph study in 65-year-old subjects. *Community Dent Oral Epidemiol* 1995;23(02):114–118
- 8 Kullar AS, Miller CS. Are there contraindications for placing dental implants? *Dent Clin North Am* 2019;63(03):345–362
- 9 Hwang D, Wang HL. Medical contraindications to implant therapy: Part II: relative contraindications. *Implant Dent* 2007;16(01):13–23
- 10 Liddelw G, Klineberg I. Patient-related risk factors for implant therapy. a critique of pertinent literature. *Aust Dent J* 2011;56(04):417–426, quiz 441
- 11 Martin W, Lewis E, Nicol A. Local risk factors for implant therapy. *Int J Oral Maxillofac Implants* 2009;24(Suppl):28–38
- 12 Adell R, Lekholm U, Rockler B, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg* 1981;10(06):387–416
- 13 Moraschini V, Poubel LA, Ferreira VF, Barboza EdosS. Evaluation of survival and success rates of dental implants reported in longitudinal studies with a follow-up period of at least 10 years: a systematic review. *Int J Oral Maxillofac Implants* 2015;44(03):377–388
- 14 Colvin J, Dawson DV, Gu H, Marchini L. Patient expectation and satisfaction with different prosthetic treatment modalities. *J Prosthodont* 2019;28(03):264–270
- 15 Hare A, Bird S, Wright S, Ucer C, Khan RS. Current undergraduate dental implantology teaching in UK. *Dent J* 2022;10(07):127. Doi: 10.3390/dj10070127
- 16 Cheung MC, Hopcraft MS, Darby IB. Implant education patterns and clinical practice of general dentists in Australia. *Aust Dent J* 2019;64(03):273–281
- 17 Saad I, Salem S. Knowledge, awareness, and perception of dental students, interns, and freshly graduated dentists regarding dental implant complications in Saudi Arabia: a web-based anonymous survey. *BMC Oral Health* 2021;21(01):161. Doi: 10.1186/s12903-021-01506-2
- 18 Chatterjee U, Srivastava A, Singh A, Aggarwal A, Jagdish C, Sharma A. Knowledge, attitude, and practice toward impression technique and materials for recording impression in implant placement among dental practitioners in Patna City, Bihar. *J Int Soc Prev Community Dent* 2018;8(05):463–468