

Knowledge, Awareness, and Practices toward Management of Perforation among Dentist and Dental Students in KSA: A Cross-Sectional Study

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Abstract

Any mechanical or pathological connection between the root canal system and the external periodontium is called Perforation. Pathogenic perforations are caused by root resorption and deep carious lesions, and iatrogenic perforations are caused by access cavity and post space preparations and root canal instrumentations. Time, size, and location are significant factors that influence the prognosis for treatment a perforation. This study aimed to assess the knowledge, awareness, and practice level of perforation management among dentists, dental interns and dental students in Saudi Arabia. This is an observational cross-sectional study. It was conducted from February 2022 to November 2022 in Saudi Arabia. The study population consisted of senior undergraduate dental students of both genders in dental school, Intern and Dentists in Saudi Arabia. Data was then transfer to the Statistical Package of Social Science Software, to be statistically analyzed. The study included 439 participants, 55.1% of them were males and 44.9% were females. 33.7% were dental interns and 47.8% were GP. Knowledge score of root perforations among study participants, was 82.9% average knowledge, 5.7% were good, and 11.4% were poor. Regarding attitude score of root perforations among study participants, 88.8% had positive attitude while 11.2% had negative attitude. As for practice Score of root perforations among study participants, we have found that 5.2% were average 13.2% were poor and 81.5% were good. The study shows inadequate knowledge scores of root canal perforations among Saudi dentists. However, good attitude and practice were noted.

Keywords: Pathogenic perforation, Iatrogenic perforation, Management

INTRODUCTION

The term "perforation" refers to any mechanical or pathological connection between the root canal system and the external structures (periodontium) [1]. The root resorption and deep carious lesions that could cause it are pathogenic perforation, or iatrogenic as during access cavity, instrumentation and post space preparation [2]. The approaches used to assess and evaluate a perforation Direct visual examination, paper points for bleeding, electronic apex locators, symptomatic findings, dental operating microscopes, cone beam computed tomography (CBCT), radiographs, and dental loupes for magnification [3]. Time, size, and location are significant factors that influence the prognosis for treatment a perforation [4]. Measure frequency type of error during root canal instrumentation the Apical perforation was higher in mandibular-teeth 21.5% than in maxillary-teeth 15.6%. Apical-perforation did not different between the jaws [5].

The most recent advancements during the previous ten years, a search was conducted in articles published between 2005 and 2015. Mineral trioxide aggregate, root perforations,

sealing-capacity. For publications detailing the sealing of the crown and root-perforations utilize Mineral trioxide aggregate and other materials, a search was conducted [6]. The first molar teeth are the most commonly the ones that receive endodontic therapy. According to the results of the current survey, the posterior dentition was 63.96 percent of mishaps [7].

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In 2020, Saveetha Dental College conducted a cross sectional survey-based study among 118 recently graduated interns, and students to assess their Endodontic perforation's prevalence and the knowledge of managing such cases. The results were 61% of them made perforations during their private practices, or while studying, but their overall awareness regarding the perforation managements and the need for repair was fairly good [8].

Another study published to evaluate the iatrogenic mistakes specifically to mark the perforation's frequency done by 6th year dental students in the Sofia Medical University during the study years of 2015 and 2016. 778 teeth were assessed and 30 teeth of them have dental perforations that represent 3.9% of the sample size. Perforation's frequency amongst these students was low and similar to that happened by a Bulgarian general dentist, and the reasons of these perforations were due to the treatment of old patient with calcified canals and many teeth for re-treatment [9].

Also, there is a retrospective study published in 2019 for the assessment of success and failure rate, in addition to the factors affecting the result of initial root canal treatment among undergraduate students in the Faculty of Dentistry at Naresuan University in school years from (2010-2015). Evaluation of the collected 213 teeth included premolars and anteriors was done, success rate amongst the teeth was 72.8%, whilst the failure rate was 27.2%. The calling of the treated patients and the presence of preoperative lesions were the factors affecting the end-result [10].

The knowledge, awareness, and practice level regarding root perforation management among dentists and dental students in Saudi Arabia, has not yet been thoroughly assessed, so this study aimed to assess the knowledge, awareness, and practice level of perforation management among dentists and dental students in Saudi Arabia. Our study objective is to assess the knowledge, awareness, and practice level of perforation management among dentists, dental intern and students in Saudi Arabia.

MATERIALS AND METHODS

Study Design

This is an observational study. It was conducted from February 2022 to November 2022 in Saudi Arabia. The study population consisted of senior undergraduate dental students of both genders in the dental school, Interns and Dentists in Saudi Arabia.

Inclusion and Exclusion Criteria

In this study we were include dental student, intern and dentist adult, and who agreed to participate in our study. The people who more than 60 years we were exclude them.

Sample Size

The sample size was estimated using the Qualtrics calculator with a confidence level of 95%; a sample size of 384. The Sample size was established using the formula:

$$n = P (1-P) * Z\alpha / d^2 \text{ with a confidence level of 95\%} \quad (1)$$

n: Calculated sample size

Z: The z-value for the selected level of confidence (1- α) = 1.96.

P: An established prevalence of knowledge

Q: (1 - 0.50) = 50%, i.e., 0.50

D: The maximum acceptable error = 0.05.

So, the calculated minimum sample size was:

$$n = (1.96)^2 \times 0.50 \times 0.50 / (0.05)^2 = 384 \quad (2)$$

Method for Data Collection and Instrument (Data Collection Technique and Tools)

Self-administered anonymous structured online questionnaire was developed, the questionnaire consisted of 29 questions with four components including sociodemographic data, the question about knowledge, attitude, and practice of dental general practitioners regarding root perforations, the answers score was given one point for each correct answer and zero points for each incorrect answer.

The questionnaire consists of the following sections:

First, sociodemographic data including age, gender, professional status, university, year of experience.

Second, the knowledge regarding root perforations, this section includes 14 questions, the scores of knowledges was classified into three levels as follows:

High level: 12-14 scores; moderate level 11-12; and low level: 0-9 scores.

Third, the attitude regarding root perforation, this part consists of 6 questions, the scores of attitudes were classified into two levels as follow:

Positive attitude: 3-6 scores; 2. negative attitude: 0-3 scores

Fourth, the practice regarding root perforations, this section includes 9 questions, the scores of practices regarding root perforations were classified into three levels as follows:

Good: 6-9 scores; fair: 5-6 scores; poor: 0-4.

Pilot Test

The opinion poll was dispersed on 20 individuals and asked to fill it. This was done to test the simplicity of the questionnaire and the feasibility of the study. Data of the pilot study was excluded from the final data of the study.

Analyzes and Entry Method

A questionnaire developed by Google Forms was used to collect data. The data entry and statistical analysis was

accomplished by the Statistical Package of Social Science Software (SPSS) program, version 20.

The study included 439 participants, 55.1% of them were males and 44.9% were females. 33.7% were dental interns and 47.8% were GP. 95.4% of sample study dentistry in Saudi Arabia. 28.7% of participant practiced dentistry for less than 1 year, 28.9% for 1- 3 years and 20.3% for 4- 6 years as illustrated in **Table 1**.

RESULTS AND DISCUSSION

Table 1. Sociodemographic characteristics of participants (n=439)

Parameter	No.	%	
Age	less than 20	2	.5
	20- 30	396	90.2
	31- 40	31	7.1
	41 - 50	8	1.8
	51 - 60	2	.5
Gender	Male	242	55.1
	Female	197	44.9
Current profession	DENTAL INTERN	81	18.5
	DENTAL STUDENT	148	33.7
	G. P	210	47.8
Study dentistry in Saudi Arabia	Yes	419	95.4
	No	20	4.6
Years of Practicing Dentistry	<1	126	28.7
	- 1-3	127	28.9
	- 4-6	89	20.3
	- ≥ 7	29	6.6
	not yet	68	15.5

As shown in **Figure 1**; knowledge score of root perforations among study participants, was 82.9% average knowledge, 5.7% were good, and 11.4% were poor.

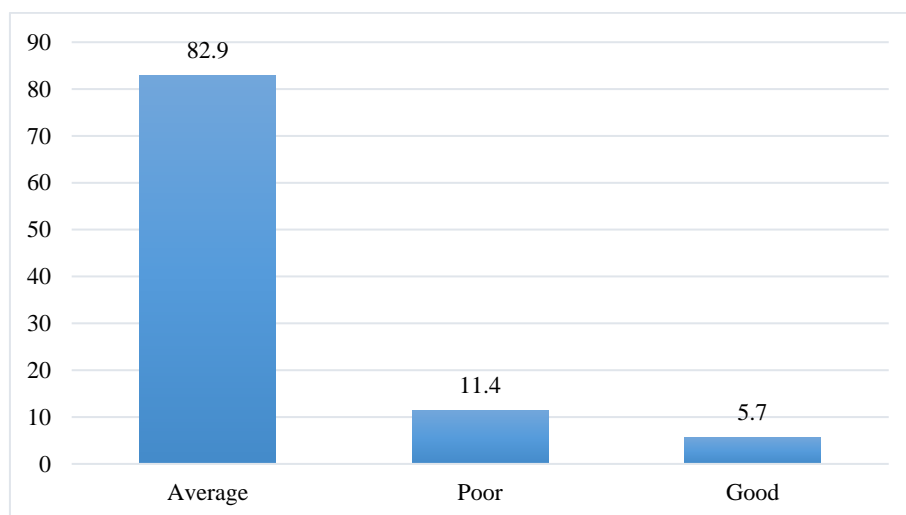


Figure 1. Knowledge score of root perforations among study participants

Table 2 shows that 73.1% out of 439 participants have read about the danger zone and 47.6% showed awareness that the danger zone in mandibular molar is the distal surface of the mesial root. We also have found that 92% showed awareness

that Prevention of root perforation occurred by knowledge of tooth morphology, location and angulation of the tooth and radiograph of teeth from different angles. There was also 86.6% of our participant knew different methods to minimize

perforations, we have also found that 69.7% considered that Cone-beam computed tomography (CBCT) was the most important resource for the diagnosis and prognosis of root perforation. Regarding the cause, 54% found that the most causative factor of root perforation was a combination of both

pathological alteration and an operative procedural accident. Regarding the risk factors, 69% found that calcification, pulp stones and tooth malposition were among the major risk factors for root perforation.

Table 2. Knowledge of participants of online nutritional applications and tele-dietetics (n=439)

Parameter	No.	%	
Read about the danger zone	Yes	321	73.1
	No	118	26.9
Danger zone in mandibular molar is	- Distal surface of the distal root	56	12.8
	- Distal surface of the mesial root	209	47.6
	- Mesial surface of the distal root	115	26.2
	- Mesial surface of the mesial root	59	13.4
	- Knowledge of tooth morphology	22	5.0
Prevent root perforation occurrence by	- Location and angulation of the tooth	11	2.5
	- Radiograph of teeth from different angles	2	.5
	- All of the above	404	92.0
	- Do not do instrumentation without lubricants	3	.7
Perforations could be minimized by	- Do not force the file inside the canal	16	3.6
	- Non-end cutting burs	24	5.5
	- using Endo microscope	16	3.6
	- All of the above	380	86.6
The most important resource for the diagnosis and prognosis of root perforation is	- Bitewing radiograph	18	4.1
	- Cone-beam computed tomography (CBCT)	306	69.7
	- PA radiograph	115	26.2
	- an operative procedural accident	188	42.8
The most causative factor of root perforation is	- pathological alteration	14	3.2
	- all of the above	237	54.0
	- Canines	11	2.5
In which teeth root perforation occurs more	- Incisors	26	5.9
	- Molars	352	80.2
	- Premolars	50	11.4
	- Extraction	23	5.2
Management of root perforation could be done by	- None of the above	49	11.2
	- Surgical or Nonsurgical approach	367	83.6
	- Extent	13	3.0
Clinical factors influence the prognosis and healing of root perforations	- Location	44	10.0
	- Treatment timeline	12	2.7
	- All of the above	370	84.3
Immediately sealed root perforation influences the prognosis and healing of such cases	Yes	407	92.7
	No	32	7.3
Perforation location has the best prognosis	- Apical to the crest of bone and epithelial attachment	252	57.4
	- furcal root perforation	94	21.4
	- Middle root perforation	93	21.2
Perforation location has the worst prognosis	- Apical to the crest of bone and epithelial attachment	126	28.7
	- furcal root perforation	208	47.4
	- Middle root perforation	105	23.9
Perforation size has the best prognosis	- Large	15	3.4

	- Medium	36	8.2
	- Small	388	88.4
If perform a root perforation was inform patient	- Yes	409	93.2
	- No	30	6.8
Inform patient and complete treatment in another appointment	- Yes	177	40.3
	- No	262	59.7
Inform your patient and complete treatment in the same visit	- Yes	264	60.1
	- No	175	39.9
Inform patient and refer him to another specialist	- Yes	350	79.7
	- No	89	20.3
Root perforation was impact root canal treatment	- Yes	365	83.1
	- No	74	16.9
Root perforations must be repaired	- Yes	404	92.0
	- No	35	8.0
Perform iatrogenic root perforation during root canal treatment before	- Yes	164	37.4
	- No	275	62.6
Face pathological root perforation before	- Yes	136	31.0
	- No	303	69.0
How to know if perform a root perforation	- Sudden bleeding	74	16.9
	- Sudden pain	21	4.8
	- All of the above	344	78.4
	- Leave it	26	5.9
How to deal with root perforation	- Refer to a specialist	251	57.2
	- repair it	162	36.9
	- Calcium Hydroxide	21	12.96
	- Glass ionomer	15	9.26
If repair, what is the best material could be used	- Mineral Trioxide Aggregate (MTA)	75	46.30
	- premixed bioceramic	51	31.48
	1- superior handling properties.	49	11.2
	2- lower cytotoxicity and a higher level of cell attachment	32	7.3
if you choose premixed bioceramic, what are its advantages over MTA?	3- superior sealability	21	4.8
	4- all of the above	151	34.4
	5- MTA is the best	186	42.4
if you repair the perforation, was you follow up on the case?	- Yes	106	65.4
	- No	56	34.6
If you followed up, what results do you find?	- Good prognosis	58	54.7
	- Poor prognosis with treatment failure	48	45.3
	- Loss of lamina dura continuity	18	37.5
If it is a poor prognosis, what was the periapical tissue state?	- Periapical abscess	19	39.6
	- Periodontitis	6	12.5
	- Within normal	5	10.4

As shown in **Figure 2**; Regarding different factors may predispose to root perforation 69% of study participants chose all of the above (tooth malposition, pulp stones,

calcification) and only 12.30% of study participants chose tooth malposition as factors may predispose to root perforation.

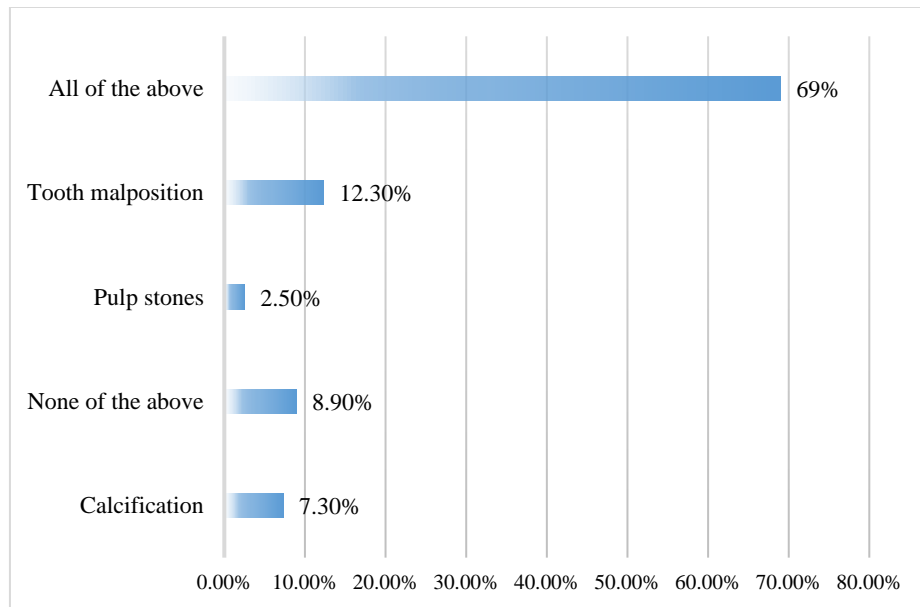


Figure 2. Different factors may predispose to root perforation among study participants

Regarding attitude score of root perforations among study participants, 88.8% had positive attitude while 11.2% had negative attitude (**Figure 3**).

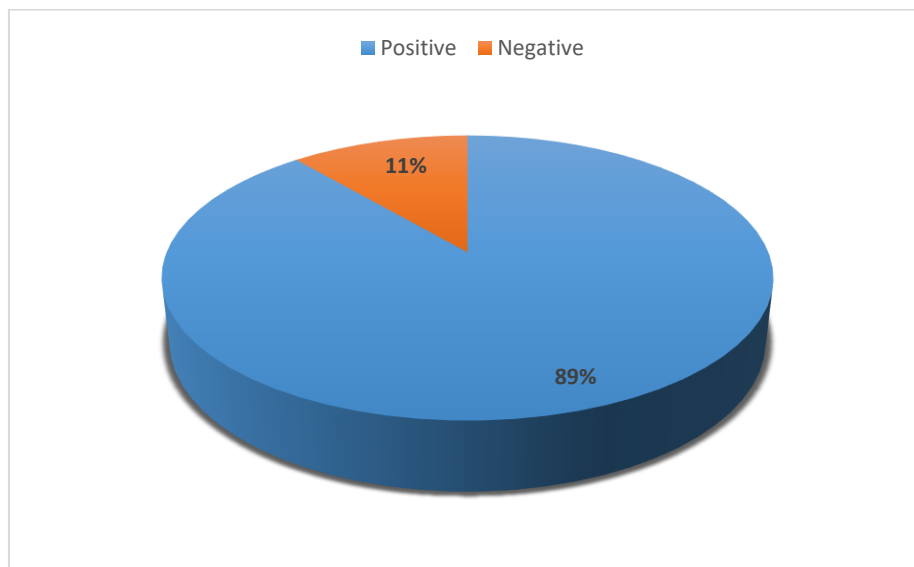


Figure 3. Attitude Score Regarding Root Perforations among study participants

As for practice Score of root perforations among study participants, we have found that 5.2% were average 13.2% were poor and 81.5% were good (**Figure 4**).

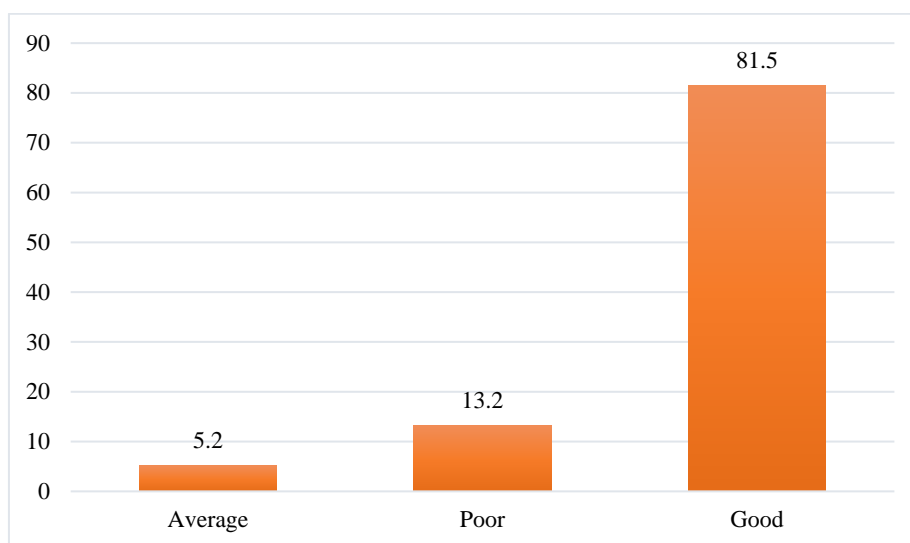


Figure 4. Practice Score Regarding Root Perforations among study participants

Table 3 shows that knowledge score was significantly associated with Current professional status and gender.

Table 3. Association between knowledge scores with sociodemographic characters of participants (n=439)

		Knowledge score			Total (N=439)	P value
		Good	Average	Poor		
Age	less than 20	0	1	1	2	0.058
		0.0%	0.3%	2.0%	0.5%	
	20-30	24	325	47	396	
		96.0%	89.3%	94.0%	90.2%	
	31-40	0	29	2	31	
		0.0%	8.0%	4.0%	7.1%	
41-50	0	8	0	8		
	0.0%	2.2%	0.0%	1.8%		
51-60	1	1	0	2		
	4.0%	0.3%	0.0%	0.5%		
Gender	Male	12	38	192	242	0.006
	48.0%	76.0%	52.7%	55.1%		
	Female	13	12	172	197	
	52.0%	24.0%	47.3%	44.9%		
Current professional status	Dental intern	7	67	7	81	0.001
	28.0%	18.4%	14.0%	18.5%		
	Dental student	6	108	34	148	
	24.0%	29.7%	68.0%	33.7%		
	GP	12	189	9	210	
Study dentistry in Saudi Arabia	48.0%	51.9%	18.0%	47.8%	0.968	
	yes	24	347	48		419
	96.0%	95.3%	96.0%	95.4%		
	no	1	17	2	20	
	4.0%	4.7%	4.0%	4.6%		

The root-canal-system and the supporting tissues of the teeth can artificially communicate with one other through perforation. If root perforation is not appropriately handled, the prognosis is compromised and the treatment is complicated. In the literature, a wide range of materials have been proposed to seal the perforations. Numerous comparison studies demonstrate the superior effectiveness of one material over another [11].

Root-perforations can happen iatro-genically during root canal therapy or patho-logically as a result of resorption and caries. If these holes are not healed, the treatment outcome may be compromised and they may continue to be a serious consequence. Perforation could happen during access-cavity preparation, in the post-operative period, or as a result of internal-resorption spreading into the periradicular-tissues [12].

The prognosis varies depending on the characteristics mentioned for single-rooted teeth in multi-rooted teeth where the furcation is punctured. About 2-12percent of teeth that have undergone endodontic-treatment do accidentally have holes in the roots, which could have detrimental effects [13]. This incision operates as an open channel for bacterial infiltration from periodontal or root canal tissues, or both, inducing an inflammatory reaction that leads to fistulae and the possibility of subsequent bone resorption processes. There may be excessive gingival epithelial growth toward the perforation site when perforation occurs laterally or in the area of the furcation, which could impair the tooth's prognosis [14].

The prognosis of a tooth with perforation-defects is sufficiently known. The size and location of the defect, time, the length of exposure to pollution, the substance used to repair it, the likelihood of sealing the perforation, and the accessibility to the main canal are all factors that affect the prognosis [15]. A positive prognosis was always given to minor perforations that were rapidly stitched up and located apically to the crestal bone. The selection of the substance to be utilized, which improves treatment outcomes, is a factor that the operator may manage. As root restoration materials, amalgam, EBA, calcium phosphate, and cavity were traditionally employed. To assess the benefits and drawbacks of newly introduced materials, information is crucial [16]. Regarding knowledge score of root perforations among study participants, we have found that 82.9% were average knowledge, 5.7% were good, and 11.4% were poor. Regarding attitude score of root perforations among study participants, we have found that 88.8% had positive attitude while 11.2 had negative attitude. Regarding practice Score of root perforations among study participants, we have found that 5.2% were average 13.2% were poor and 81.5% were good.

In 2020, Saveetha Dental College conducted a cross sectional survey-based study among 118 recently graduated interns [8], and students to assess their Endodontic perforation's

prevalence and the knowledge of managing such cases. The results were 61% of them made perforations during their private practices, or while studying, but their overall awareness regarding the perforation managements and the need for repair was fairly good [17]. Another study conducted in Birjand, Northeast Iran [18], revealed that most participants had a moderate level of knowledge. Additionally, it demonstrated that everyone who took part had a favorable general and individual opinion regarding the root perforation characteristics. This result generally agreed with a survey from South Africa that revealed that the majority of people there had an optimistic outlook. However, due to the differences in how the questions and evaluation procedures were designed, it was challenging to compare items one to another. Many participants in a study on dentistry students' understanding of oral and periodontal health were aware of this problem [19]. Another study published to evaluate the iatrogenic mistakes specifically to mark the perforation's frequency done by 6th year dental students in the Sofia Medical University during the study years of 2015 and 2016. 778 teeth were assessed and 30 teeth of them have dental perforations that represent 3.9% of the sample size. Perforation's frequency amongst these students was low and similar to that happened by a Bulgarian general dentist, and the reasons of these perforations were due to the treatment of old patient with calcified canals and many teeth for re-treatment [20].

In our study, we have found a significant relationship between knowledge score and the current professional status (p value = 0.001). Three studies statistically evaluated the experience of the provider in relation to the occurrence of perforations [21-23], According to one study, there was no discernible difference in the kind or frequency of procedural errors between students in their fourth and fifth years. According to a second study, root perforations were more common in procedures performed by 5th-year students than by 4th-year students, and they had a significant relationship with the student's educational level ($P = 0.016$). The authors hypothesized that the higher rate of perforations in 5th-year students might be related to their increased procedural risk due to their increased confidence and decreased radiograph usage, or to the fact that they had less clinical supervision than 4th-year students. According to a third study, 4th-year students made much more root perforations than 5th-year students, but 5th-year students significantly more foramen perforations. Only one study [24]. reported perforations during treatments carried out by postgraduate endodontic students, and no studies evaluated rates of perforation in general dentists or endodontists.

CONCLUSION

The study shows inadequate knowledge scores of root canal perforations among Saudi dentists. However, good attitude and practice were noted. As a result, dentists' understanding of the normal variation in root canal morphology, as well as

their training in the use of novel procedures, should be promoted throughout their clinical careers.

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