Original Article

Knowledge and Attitude Assessment of the Undergraduate Dental Students in KSA Regarding the Management of Post-Space Perforation

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Abstract

Restoring endodontically treated teeth is an essential step to preserve the remaining tooth structure and retain the core build-up. The prognosis of the perforated tooth will depend on the lesion location, size, and the time elapsed between the incident and the repair. Our study aimed to assess the knowledge and attitudes of undergraduate dental students in Saudi Arabia about post-space perforation management. This cross-sectional study was conducted in Saudi Arabia. An online survey was distributed among dental students and interns in Saudi Arabia. The collected data was exported to "Microsoft Office Excel Software". The statistical analysis was done through the (SPSS) Software. The study included 388 participants, 57.5% of them were females and 42.5% were males. 13.1% were GP and 28.6 were dental interns. 58% had a moderate knowledge score, 30.7% had good knowledge and 11.3% had poor knowledge. As for awareness, 76.8% of participants had good awareness, 19.1% had moderate awareness and 4.1% had poor awareness. Regarding practice, 21.6% have a good practice, 62.9% have moderate practice and 15.5% had poor awareness. There was a significant association between knowledge scores in the academic year. Meanwhile, awareness score was significantly associated with the type of university. Practice score was not associated with any of the sociodemographics. The study concluded that Saudi dentists had poor knowledge, moderate practice, and good awareness regarding the management of post-space perforation. University should undertake educational programs for dental students to enhance their knowledge and awareness of post-space perforation management.

Keywords: Post space, Perforation management, Post space preparation, Student knowledge, Perforation repair

Introduction

Restoring endodontically treated teeth is an essential step to preserve the remaining tooth structure. The structural and functional changes due to caries, previous restoration, secondary caries, fractures, and RCTs will affect and weaken the tooth structure [1]. For that, post-placement following endodontic treatment provides retention to the core build-up [1, 2]. Losing the root strength after endodontic therapy will predispose the root walls to a higher chance of perforation and fracture during post-drilling [3].

Root perforation can be caused by a non-iatrogenic and iatrogenic procedural error. Most iatrogenic misshape occurs during 53% of prosthodontic treatment, such as cases of strep perforation [2]. In addition, 47% of the cases related to root canal perforation during endodontic treatment at the apical part of the furcal floor of multi-rooted teeth [3]. Mandibular Maxillary teeth (74.5%) [4]. Root canal perforation is the second most common cause of treatment failure due to the external communication with the oral cavity and the exposure

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to the oral flora and micro-organisms that will lead to tooth extraction in 4.2 % of the cases [4, 5].

Conservative selection of the post-diameter size, which is not larger than one-third of the root thickness, will prevent post-space perforation [6]. Furthermore, post-space preparation with post-drill must follow the canal path and long axis of the tooth and should avoid the path of most resistance [4]. Moreover, using heated rotary and hand instruments to remove the coronal gutta-percha produces a pilot point to be followed by the post-drill [5].

The successful repair of a root canal perforation is done by an immediate seal with bio-compatible material, such as calcium hydroxide (Ca(OH)2) or bio-ceramic [6]. The prognosis of a perforated tooth will depend on the lesion location, size, and the time elapsed between the incident and the repair [7].

We will perform this study, due to the insufficient number of studies related to our topic, especially in Saudi Arabia. Moreover, dental students need to know the correct diagnosis and management of root perforation during post-space preparation to avoid treatment failure and future complications. This study aimed to assess the knowledge and attitudes of undergraduate dental students in Saudi Arabia about the management of perforation during post-space preparation. This study aims to assess the knowledge of dental students and interns in Saudi Arabia regarding the post-space preparation principle. Moreover, to evaluate the awareness of undergraduate students regarding perforation management and the correct choice of perforation repair material.

Materials and Methods

This cross-sectional study was conducted in Saudi Arabia for six months between July 2022 - December 2022. An online survey was distributed among dental students and interns in Saudi Arabia. The inclusion criteria of the participants, male and female, dental students and interns, and Saudi-based dental school (privet or governmental), agree to participate in the questionary. The exclusion criteria will include graduated dental students, other health college students, and non-Saudi dental school students.

The questionnaire section's design will follow the (KAP) to assess and measure the population's knowledge, attuited, and practice. Therefore, section (I) will collect the participant's demographic data after agreeing to participate. Section (II); will assess the target population's knowledge about post-space perforation and its prevalence and occurrence. These questions have a Scoring system were (Yes) has 2 points, (No) has 1 point, and (I don't know) has 0 point.

Section (III); the scoring system was between 1-4 points to assess the awareness level. For that, the points distribution on each answer was: "Strongly Disagree" have 0-point, "Disagree" have 1-point, "Not Sure" have 2-point, "Agree" have 3-point, and "Strongly Agree" have 4 points. Section (IV); to assess the practice level, the points distribution (5-4-3-2-1-0) will apply to the answer "always," "mostly," "sometimes," "rarely," and "never," respectively. All the applied questions will enter through a google form link and distributed online through email and social media.
In this cross-sectional survey, A sample size calculation was done by (the Raosoft sample size calculator program)—the marginal error setting at the most common value of 5%. The selection of response distribution of the population at the calculating formula was selected to be 50%. The confidence level settings were chosen to be at 95%—the result of the calculation with a minimum of 384 population size.

We are exporting the collected data from the google form/survey to the "Microsoft Office Excel Software" program (2016) for windows. The statistical analysis was done through the (SPSS) program-Statistical Package of Social Science Software, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

Results and Discussion

The study included 388 participants, 57.5% of them were females and 42.5% were males. 78.4% were in government universities and 21.7% were from a private universities. 13.1% were GP, 28.6 were dental interns, 12.6% were in the fourth year, 16% were in the fifth year and 29.7% were in the sixth year.

Table 1. Sociodemographic characteristics of participants (n=388)

Parameter		No.	%
Gender	Male	165	42.5
	Female	223	57.5
Region	Central Region	91	23.5
	Eastern	69	17.8
	Northern	70	18.0
	Southern	49	12.7
	Western	109	28.1
University	Government university	304	78.4
	private university	84	21.7
Academic year	GP	51	13.1
	Intern year	111	28.6
	Fourth year	49	12.6
	Fifth year	62	16.0
	Sixth year	115	29.7

As illustrated in **Table 2**, 58% had a moderate knowledge score, 30.7% had good knowledge and 11.3% had poor knowledge. As for awareness, 76.8% of participants had good awareness, 19.1% had moderate awareness and 4.1% had poor awareness. Regarding practice, 21.6% have a good practice, 62.9% have moderate practice and 15.5% had poor awareness.

Table 2. KAP scores about post-space perforation among study participants (n= 388)

Parameter		No.	%
Knowledge score	Poor knowledge	44	11.3
	Moderated knowledge	225	58.0
	Good knowledge	119	30.7
Awareness score	Poor awareness	16	4.1
	Moderated awareness	74	19.1
	Good awareness	298	76.8
Practice score	Poor practice	60	15.5
	Moderated practice	244	62.9
	Good practice	84	21.6

As illustrated in **Table 3**, 22.7% of participants have encountered perforation in their clinical practice. 80.9% reported MTA as the best material for perforation repair histologically and clinically while 103% reported calcium hydroxide. 37.6% reported mandibular molar as the most common teeth to have a perforation.

Table 3. Knowledge of participants of post-space perforation management (n=388)

Parameter		No.	%
Number/s of posts you have placed in your dental practice?	>9	39	10.1
	7-9	216	55.7
	4-6	106	27.3
	1-3	27	7.0
How much time did you spend during post and core preparation	Half hour	78	20.1
	One hour	159	41.0
	Two hours	106	27.3
	Three hours	31	8.0
	More	14	3.6
Have you encountered perforation in your clinical practice	Yes	88	22.7
	No	300	77.4
Where is the danger zone located in the mandibular first molar?	Distal area of the mesial root	163	42.0
	Mesial area of the distal root	95	24.5
	Middle area of the mesiobuccal root	62	16.0
	I don't know	68	17.5
which of the following material considered the best material for perforation repair histologically and clinically	Calcium hydroxide	40	10.3
	Zinc phosphate	11	2.8
	MTA	314	80.9
	I don't know	23	5.9
Root canal perforation occurs mostly during endodontic treatment, not during prosthodontic procedures	Yes	209	53.9
	No	134	34.5
	I don't know	45	11.6
Perforation is the most common cause that indicates a tooth extraction	Yes	116	29.9
	No	226	58.2
	I don't know	46	11.9
To avoid root perforation the post width should be	Half the root width	31	8.0
	One-third of the root width or less	5	1.3
	One-third of the root width	255	65.7
	One-fourth of the root width	43	11.1
	I don't know	54	13.9
We can use only Endo-Z bur instead of using gates glidden and peeso reamer burs during post and core preparation	Yes	81	20.9
	No	245	63.1
	I don’t know	62	16.0
The most common teeth to have perforation:	Anterior maxillary teeth	52	13.4
	Mandibular molar	146	37.6
	Maxillary molars	123	31.7
	I don't know	67	17.3
Which condition has a good prognosis?	Large size defect in the coronal third	33	8.5
	Small size defect in the apical third	153	39.4
	Small size defect in the coronal third	159	41.0
	Small size defect in the middle third	31	8.0
	Large-size defect in a sterile condition	1	.3
	Small-size defect in a sterile condition	11	2.9
Which condition has a poor prognosis?	Large size defect in the coronal third	65	16.8
	Small size defect in the apical third	51	13.1
	Small size defect in the coronal third	10	2.6
	Small size defect in the middle third	31	8.0
	otherwise	231	59.5
How much time do we wait before inserting a post after the obturation of a symptomatic tooth?	One day	74	19.1
	Three days	60	15.5

	One week	178	45.9
	One month	76	19.6

40.2% of participants strongly agree that post-space perforation occurs when the post-drill deviates from the long access of the tooth, 41% strongly agree that immediate perforation repair indicates a successful prognosis, 27.1% strongly agree that restoring the tooth after perforation better done with Prefabricated Fibre reinforced composite (FRC) posts due to superior esthetics, micromechanical adhesion to the tooth structure.

Table 4. Awareness of participants of post-space perforation (n=388)

Parameter		No.	%
Post space perforation occurs when the post drill deviates from the long access of the tooth.	1	16	4.1
	2	19	4.9
	3	88	22.7
	4	109	28.1
	5	156	40.2
Immediate perforation repair indicates a successful prognosis.	1	17	4.4
	2	20	5.2
	3	96	24.7
	4	96	24.7
	5	159	41.0
The safest way to create post space without perforation is using gates glidden	1	34	8.8
	2	36	9.3
	3	129	33.2
	4	89	22.9
	5	100	25.8
In post-preparation with gates glidden is recommended that the largest bur size does not exceed the canal diameter	1	23	5.9
	2	29	7.5
	3	112	28.9
	4	103	26.5
	5	121	31.2
Restoring the tooth after perforation is better done with Prefabricated Fibre reinforced composite (FRC) posts due to superior esthetics, micromechanical adhesion to the tooth structure	1	12	3.1
	2	36	9.3
	3	133	34.3
	4	102	26.3
	5	105	27.1

Table 5. Practice of participants of post-space perforation (n=388)

Parameter	Always	Mostly	Never	Rarely	Sometimes
Order to be followed when using Gates Glidden for gutta-percha removal is from the largest to the smallest	53 13.7%	89 22.9%	137 %35.4	29 7.5%	80 20.6%
Repairing perforation best done with MTA or Biodenten	183 %47.2	132 34.0%	2 .5%	9 2.3%	62 16.0%
It is ideal to treat Endodontically treated teeth by post and core when it is >50% decayed?	99 %25.6	158 40.7%	16 4.1%	20 5.2%	95 24.5%
The best sequence for burs used during gutta-percha removing and widding the canal is size 1:gates glidden then size 1: peeso reamer, size 2: gates glidden then size 2: peeso reamer, size 3:gate glidden then size 3: peeso reamer?	68 %17.6	117 30.2%	27 7.0%	28 7.2%	148 38.1%
Preoperative radiograph is an essential step before starting post-space preparation	254 %65.5	52 13.4%	2 .5%	5 1.3%	75 19.3%
Perforation repair requires surgical intervention only	24 6.2%	50 12.9%	34 %8.8	78 20.1%	202 52.1%

According to **Tables 6 and 7**, there was a significant association between knowledge scores in the academic year. Meanwhile, awareness score was significantly associated with the type of university. Practice score was not associated with any of the sociodemographics.

Table 6. Association between Knowledge scores of participants with sociodemographic characters (n=388)

	Knowledge score	Total (N=388)	P value

		Poor	Moderate	Good		
Gender	Male	24 54.5%	135 60.0%	64 53.8%	223 57.5%	**0.495**
	Female	20 45.5%	90 40.0%	55 46.2%	165 42.5%	
Region	Northern	7 15.9%	37 16.4%	26 21.8%	70 18.0%	**0.498**
	Central Region	10 22.7%	51 22.7%	30 25.2%	91 23.5%	
	Eastern	12 27.3%	38 16.9%	19 16.0%	69 17.8%	
	southern	3 6.8%	28 12.4%	18 15.1%	49 12.7%	
	Western	12 27.3%	71 31.6%	26 21.8%	109 28.1%	
University	Government School	40 90.9%	175 77.8%	89 74.8%	304 78.4%	**0.135**
	Private School	4 9.1%	50 22.2%	30 25.2%	84 21.7%	
Academic year	GP	7 15.9%	26 11.6%	18 15.1%	51 13.1%	**0.002**
	Intern year	13 29.5%	73 32.4%	25 21.0%	111 28.6%	
	Fourth year	11 25.0%	17 7.6%	21 17.6%	49 12.6%	
	Fifth year	1 2.3%	35 15.6%	26 21.8%	62 16.0%	
	Sixth year GP	12 27.3%	73 32.8%	29 24.4%	115 29.7%	

Table 7. Association between practice scores of participants with sociodemographic characters (n=388)

		Practice Score			Total (N=388)	P value
		Poor	Moderate	Good		
Gender	Male	24 40.0%	111 45.5%	30 35.7%	165 42.5%	**0.269**
	Female	36 60.0%	133 54.5%	54 64.3%	223 57.5%	
Region	Northern	12 20.0%	43 17.6%	15 17.9%	70 18.0%	**0.757**
	Central Region	18 30.0%	57 23.4%	16 19.0%	91 23.5%	
	Eastern	11 18.3%	42 17.2%	16 19.0%	69 17.8%	
	Southern	3 5.0%	32 13.1%	14 16.7%	49 12.7%	
	Western	16 26.7%	70 28.7%	23 27.4%	109 28.1%	
University	Government School	41 68.3%	194 79.5%	69 82.1%	304 78.4%	**0.267**
	Private School	19 31.7%	50 20.5%	15 17.9%	84 21.7%	
Academic year	GP	11 18.3%	30 12.3%	10 11.9%	51 13.1%	**0.480**
	Intern year	16 26.7%	71 29.1%	24 28.6%	111 28.6%	
	Fourth year	9 15.0%	24 9.8%	16 19.0%	49 12.6%	
	Fifth year	7 11.7%	39 16.0%	16 19.0%	62 16.0%	
	Sixth year	17	80	18	115	

GP	28.3%	32.8%	21.4%	29.7%

The root canal system and the supporting tissues of the teeth can artificially communicate with one another through the perforation. If root perforation is not appropriately handled, the prognosis is compromised and the treatment is complicated. Periodontal disease may develop as a result of such perforations, endangering the long-term health and life of the affected tooth. As a result, some have argued in favor of tooth extraction. On the other hand, other clinicians have seen successful healing and long-term survival of perforations that have been correctly repaired using a variety of dental materials [8, 9]. 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. The literature contains numerous evaluations on perforation repair's diagnosis, course of therapy, and factors affecting prognosis; however, none of these publications go into detail about the various materials that can be used to seal the perforation [10]. In this study, we assess the knowledge of dental students and interns in Saudi Arabia regarding the post-space preparation principle. Moreover, to evaluate the awareness of undergraduate students regarding perforation management and the correct choice of perforation repair material.

The clinician must first comprehend the prognosis and course of treatment before deciding clinically whether to extract or save a tooth that has undergone endodontic perforation. An inflamed perforated tooth's biological response may destroy the osseous and periradicular tissues. A guarded long-term prognosis for the tooth can result from this. Location, magnitude, and time from incidence all play a significant role. The prognosis is better although the direct repair is more challenging the more apical the breach. The more substantial the perforation, the more challenging sealing may be. It is essential to seal a perforation right away to stop the infection from spreading to the surrounding tissue [11].

Either an internal procedure or an exterior procedure is used in the clinical treatment strategy for repairing a perforated tooth. Internal repair, or root canal therapy, can be split into directly visible perforations (coronal one-third) and those that are not (middle and apical one-third). The root canal treatment should be finished, followed by obturation with gutta-percha and a bioceramic-type sealant if the hole cannot be seen clearly. Instead of sodium hypochlorite, an anesthetic solution or sterile saline should be utilized as an irrigant due to the perforation [12].

Before establishing a permanent restoration, a matrix should be used to plug any directly visible perforations (coronal one-third). The prognosis of the perforated tooth may be further compromised if a restoration accidentally extrudes into the alveolar bone. An extra inflammatory and foreign-body reaction could result from this overfill. 6 The matrix material should be biocompatible because it was inserted into bone rather than tooth structure. The literature has documented the use of MTA, calcium sulphate, or other bioceramic materials as matrix materials [13, 14].

A previous case report studied by Mitthra *et al*. (2022) shows a successful perforation repair in a follow-up period of one-year post-operative with no sign of bony or peri-apical lesion. There was a large defect during post-space perforation, and the repair attempt was made under rubber dam isolation, with MTA as a repair material, followed by the cementation of fiber post [15]. A review article done by Manoj *et al*. (2021) concluded that; for the anterior teeth, it is better to have the access cavity more incisively which will provide straight-line access to the post-drill and will help to facilitate the space preparation and prevents perforation. Moreover, the clinician's acknowledgment of interpreting the radiographic images and estimating the remaining dentin thickness, as well as the awareness of root anatomy will reduce the chances of root perforation [4]. A systematic review done by Sarano *et al*. (2021) stated that perforation occurrences are about 0.6% - 17.6%, and the most related factors to perforation incidents are clinician experience, tooth type, and root morphology [5]. A cross-sectional study among dental students in Jeddah-Saudi Arabia, done by Zahran *et al*. (2020), found that 28.5% of the participants have had an incident related to the post-placement procedure, with 14% perforation defects among these incidents [16]. According to an endodontic clinical review done by Estrela *et al*. (2018), state that immediate repair is a must for a successful outcome and for increasing the prognosis chances. Repaired material such as MTA has an excellent histological and clinical outcome [17].

The study had a limitation as there was a lack of previous studies with the same objective as our study. Thus, we recommend future studies with larger sample sizes than the current study to support our results.

Conclusion

The study concluded that Saudi dentists had poor knowledge, moderate practice, and good awareness regarding the management of post-space perforation. University should undertake educational programs for dental students to enhance their knowledge and awareness of post-space perforation management.

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full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

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