

## Comparison of Endodontic decision making for post-obturation flare-up: A scenario-based survey

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**ABSTRACT**

**Introduction:** Endodontic management of post-obturation flare up could be confusing task for some dentist. Correct decision making on these cases will benefit on minimizing unnecessary treatment and antibiotic prescription. The aim of the study was to evaluate and compare endodontic decision making for post-obturation flare-up among dental practitioners at varying levels of education. **Methods and Materials:** A scenario-based online questionnaire was distributed among the participants via social media (WhatsApp and Twitter) during the period from (06/2020) to (08/2020). The questionnaire comprised of a demographic section and a case scenario section comprising eight hypothetical cases with supporting periapical radiographs. Participants were requested to choose one response each from seven standard treatment options and four medication options for every case. Chi square test was used to compare among different groups. Level of significance was set at  $p < 0.05$ . **Results:** The online questionnaire received a total of 391 responses from across Saudi Arabia. Results demonstrated a statistically significant difference among the different groups of participants ( $P < 0.05$ ). Endodontists showed the highest percentage of correct responses, either regarding the treatment procedure or prescribing medication, while general practitioners displayed the least. **Conclusion:** Endodontists and postgraduate residents in endodontics decision making were more conservative than undergraduate students and general practitioners. These results emphasize the need for more endodontic courses and lectures targeted toward general practitioners, and the importance of training undergraduates on decision making in endodontics.

**Keywords:** Endodontics, Decision making, Flare-up, Post-obturation

**1. INTRODUCTION**

The decision making involved in any root canal treatment does not rely merely on the diagnosis of the endodontic problem at hand, but also on assessing the appropriateness of the endodontic treatment, the difficulty of the treatment, and the elimination of procedural problems that may compromise the prognosis of the treatment (Messer, 1999). To achieve the best treatment



outcome, the dentist’s judgment should be based on basic knowledge, sufficient available evidence, and clinical expertise; clubbed with the patient’s compliance. Root canal treatment aims to prevent and intercept pulpal and periradicular pathosis. The main objective is the elimination of microorganisms and necrotic pulp by chemo-mechanical preparation of the root canal system, and to provide an adequate root filling (obturation) to seal the canals and prevent reinfection, thereby allowing healing of the periradicular tissues (American Association of Endodontists, 2018).

Endodontic flare-up is a common complication that is defined as the occurrence of severe swelling and/or pain following an endodontic treatment appointment. It usually requires an unexpected emergency visit to relieve the pain (Jayakodi et al., 2012). Although the exact reasons behind the flare-ups are not well understood, the commonness of flare-ups was examined with regard to the age, gender, tooth position, pulp and periapical conditions, preoperative sign and symptoms, operator abilities, number of appointments and treatment protocol, and a positive association was found. The incidence of flare-ups is greater in the age group of 40–60 years, with a predilection towards women (Nair et al., 2017).

The etiology of Endodontic flare-up is multifactorial; mechanical, chemical, and microbial factors contribute to the occurrence of the condition (Siqueira Jr and Barnett, 2004; Alves, 2010). Irrespective of the type of the factor, the flare-up depends on the extent and severity of the peri radicular tissue injury and the intensity of the inflammatory response. These factors are interrelated and directly interdependent. The management of endodontic flare-up depends on the clinical presentation of the case and may include one or more of the following: Pharmacological management, drainage establishment, relief of occlusion, and intracanal and systemic medication (Jayakodi et al., 2012).

This study’s aim was to compare the endodontic acumen pertaining to post-obturation flare-up, among various levels of education, namely, dental students, post graduate trainees, general practitioners, and endodontists. Additionally, shedding light on how knowledge in endodontics could help the practitioner provide a better experience and smoother operation, culminating in achieving better results.

## 2. METHODOLOGY

The work is a cross-sectional analytical study using a scenario-based online questionnaire. It was submitted to, and approved by, the ethical committee of Riyadh Elm University. The online link for the questionnaire was distributed across Saudi Arabia via social media (WhatsApp and Twitter) during the period from (06/2020) to (08/2020). The targeted populations included in this study were personnel practicing endodontic practice from four levels of education, namely, Dental Students, Post Graduate Trainees, General Practitioners, and Endodontists.

The questionnaire embodied two sections, the first of which collected demographic information like age, gender, nationality, level of education, and years in practice of the participants. The second section included eight hypothetical case scenarios supported with periapical radiographs for each case (Table 1 and Figure 1). Each hypothetical case scenario provided the participant with certain clinically relevant information, such as, the obturation quality, symptoms, and the presence of any periapical lesion. The participants were directed to choose one from each of seven treatment options and four medication options that were associated with each case (Table 2).

**Table 1** hypothetical case scenario

Case no.	Obturation quality	Pain \ symptoms	Diffuse Swelling	Periapical lesion
1	Good	YES	NO	NO
2	Good	YES	YES	NO
3	Good	YES	NO	YES
4	Good	YES	YES	YES
5	Poor	YES	NO	NO
6	Poor	YES	YES	NO
7	Poor	YES	NO	YES
8	Poor	YES	YES	YES



Figure 1 Periapical radiographs that represent each case scenario in the same order of the Table 1 from case one to case eight.

Table 2 Treatment and Medication Options

Treatment options	Non-surgical retreatment Apical surgery Incision and drainage Non-surgical retreatment in addition to incision and drainage Non-surgical retreatment and apical surgery Extraction No procedure, only wait and see
Option of medications	Analgesics only Antibiotics only Both analgesics and antibiotics No need for medicaments

Analysis of the data were done using software SPSS version 25, Armonk, NY: USA. Chi square test was used to compare among different groups. Proportions were compared by considering Bonferroni corrections. Level of significance is set at  $p < 0.05$ .

### 3. RESULTS

The sample comprised of 391 respondents (202 male, 189 female) and included undergraduate dental students, general dentists, endodontic residents, and endodontists. The distribution of the sample is summarized in Table 3. When the responses to the preferred procedure in each of the case scenarios was summarized, it was observed that Case 1 (82.6%), Case 5 (82.6%), Case 6 (79.3%), and Case 7 (78%) had relatively high numbers of correct responses. However, Case 4 (44.2%) had the least number of correct answers followed by Case 8 (50.9%), Case 2 (51.2%), and Case 3 (59.6%) (Table 4).

Table 3 Descriptive Statistics of the Sampled Population

		N	%	Mean	Standard Deviation
Gender	Male	202	51.7%		
	Female	189	48.3%		
Nationality	Saudi	251	64.2%		
	Non-Saudi	140	35.8%		
Educational level	Undergraduate student	122	31.2%		
	Post graduate resident in Endodontics	50	12.8%		
	General practitioner	159	40.7%		

	Endodontists	60	15.3%		
Age				31	8
Years of Experience				7.51	6.83

Table 4 Responses to the treatment options for each case scenario

CASE	Non-surgical retreatment		Apical surgery		Incision and drainage		Non-surgical retreatment in addition to incision and drainage		Non-surgical retreatment and apical surgery		Extraction		No Procedure only wait and see	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Case 1	44	11.3%	8	2.0%	5	1.3%	8	2.0%	2	0.5%	1	0.3%	323*	82.6%
Case 2	52	13.3%	17	4.3%	82	21.0%	31	7.9%	4	1.0%	5	1.3%	200*	51.2%
Case 3	48	12.3%	57	14.6%	11	2.8%	16	4.1%	20	5.1%	6	1.5%	233*	59.6%
Case 4	60	15.3%	33	8.4%	57	14.6%	48	12.3%	11	2.8%	9	2.3%	173*	44.2%
Case 5	323*	82.6%	6	1.5%	4	1.0%	9	2.3%	11	2.8%	33	8.4%	5	1.3%
Case 6	310*	79.3%	14	3.6%	10	2.6%	11	2.8%	8	2.0%	10	2.6%	28	7.2%
Case 7	305*	78.0%	16	4.1%	14	3.6%	20	5.1%	21	5.4%	11	2.8%	4	1.0%
Case 8	199*	50.9%	26	6.6%	16	4.1%	96	24.6%	25	6.4%	15	3.8%	14	3.6%

\*Correct Answer

When the responses to the type of medication prescribed in each case were tabulated it was observed that although a majority of the respondents gave the correct answer, there was a large number of respondents who prescribed antibiotics when they were not needed (Case 3, Case 7) or failed to prescribe antibiotics when they were indicated (Case 2, Case 4, Case 8) (Table 5). When the overall correct scores for treatment and prescription of medication were correlated it was observed that there was a significant correlation between the two ( $r=0.560$ ,  $p<0.001$ ). Separate regression models were established using the overall treatment score and overall medication prescription score as dependent variables (Table 6).

It was observed that there was a significant positive association of education level on both the correct treatment score ( $p=0.001$ ) and the correct medication score ( $p<0.001$ ) suggesting that the more educated the individual the greater the score. There was no association between the correct scores and gender, age, or years of experience (Table 6). Percentage of correct decision making for each case scenario regarding both the treatment and medication choices is summarized in Table 7.

Table 5 Responses to the medication options for each case scenario

Case	Analgesics Only		Antibiotics only		Both Antibiotics and Analgesics		No need for Medication	
	N	%	N	%	N	%	N	%
Case 1	315*	80.6%	12	3.1%	45	11.5%	19	4.9%
Case 2	94	24.0%	29	7.4%	259*	66.2%	9	2.3%
Case 3	233*	59.6%	14	3.6%	126	32.2%	18	4.6%
Case 4	83	21.2%	19	4.9%	285*	72.9%	4	1.0%
Case 5	269*	68.8%	9	2.3%	46	11.8%	67	17.1%
Case 6	280*	71.6%	15	3.8%	38	9.7%	58	14.8%
Case 7	229*	58.6%	16	4.1%	103	26.3%	43	11.0%
Case 8	83	21.2%	23	5.9%	264*	67.5%	21	5.4%

\*Correct Answer

**Table 6** Impact of demographic variables on the correct treatment score

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients Beta		
Correct Treatment Score	(Constant)	5.394	1.391		3.878	.000
	Gender	-.378	.329	-.077	-1.149	.252
	Age	-.018	.045	-.056	-.404	.687
	Nationality	-1.078	.335	-.221	-3.219	.001**
	Educational level	.666	.249	.198	2.679	.008**
	Years of Experience	.072	.048	.200	1.482	.140
Correct Medication score	(Constant)	4.883	1.159		4.213	.000
	Gender	.020	.275	.005	.075	.941
	Age	-.021	.037	-.077	-.566	.572
	Nationality	-1.185	.279	-.283	-4.249	.000**
	Educational level	.819	.207	.283	3.952	.000**
	Years of Experience	.050	.040	.163	1.248	.214

**Table 7** Percentage of correct decision making for each case scenario

The correct treatment /medication across different educational level					
Cases	Decision	Undergraduate student	Post graduate resident in Endodontics	General practitioner	Endodontics specialist
Case 1: Primary root canal treatment was done for tooth #22, quality of the treatment looks good and there is no periapical lesion. The patient presented to the clinic three days after the root canal treatment complaining of severe pain	Treatment	86.1% <sup>oa</sup>	88.0% <sup>oa</sup>	75.5% <sup>oa</sup>	90.0% <sup>oa</sup>
	Medication	84.4% <sup>oa,b</sup>	86.0% <sup>oa,b</sup>	72.3% <sup>oa</sup>	90.0% <sup>ob</sup>
Case 2: Primary root canal treatment was done for tooth #36, quality of the treatment looks good and there is no periapical lesion. The patient presented to the clinic three days after the root canal treatment complaining of severe pain and diffuses swelling.	Treatment	42.6% <sup>oa</sup>	48.0% <sup>oa,b</sup>	53.5% <sup>oa,b</sup>	65.0% <sup>ob</sup>
	Medication	67.2% <sup>oa,b</sup>	58.0% <sup>oa</sup>	61.0% <sup>oa</sup>	85.0% <sup>ob</sup>
Case 3: Primary root canal treatment was done for tooth #15, quality of the treatment looks good and there is a periapical lesion. The patient presented to the clinic three days after the root canal	Treatment	54.9% <sup>oa</sup>	78.0% <sup>ob</sup>	45.3% <sup>oa</sup>	91.7% <sup>ob</sup>
	Medication	69.7% <sup>oa</sup>	78.0% <sup>oa</sup>	38.4% <sup>ob</sup>	80.0% <sup>oa</sup>

treatment complaining of severe pain.					
Case 4: Primary root canal treatment was done for tooth #46, quality of the treatment looks good and there is a periapical lesion. The patient presented to the clinic three days after the root canal treatment complaining of severe pain and diffuses swelling.	Treatment	45.1% <sub>a,b</sub>	52.0% <sub>a,b</sub>	35.8% <sub>a</sub>	58.3% <sub>b</sub>
	Medication	68.9% <sub>a,b</sub>	62.0% <sub>a</sub>	74.2% <sub>a,b</sub>	86.7% <sub>b</sub>
Case 5: Primary root canal treatment was done for tooth #46, quality of the treatment looks poor and there is no periapical lesion. The patient presented to the clinic three days after the root canal treatment complaining of severe pain.	Treatment	87.7% <sub>a</sub>	90.0% <sub>a,b</sub>	72.3% <sub>b</sub>	93.3% <sub>a</sub>
	Medication	62.3% <sub>a</sub>	82.0% <sub>a,b</sub>	62.9% <sub>a</sub>	86.7% <sub>b</sub>

**Table 7** Percentage of correct decision making for each case scenario (Contd...)

The correct treatment /medication across different educational level

Cases	Decision	Undergraduate student	Post graduate resident in Endodontics	General practitioner	Endodontics specialist
Case 6: Primary root canal treatment was done for tooth #36, quality of the treatment looks poor and there is no periapical lesion. The patient presented to the clinic three days after the root canal treatment complaining of severe pain.	Treatment	84.4% <sub>a</sub>	80.0% <sub>a</sub>	72.3% <sub>a</sub>	86.7% <sub>a</sub>
	Medication	71.3% <sub>a</sub>	76.0% <sub>a</sub>	66.7% <sub>a</sub>	81.7% <sub>a</sub>
Case 7: Primary root canal treatment was done for tooth #22, quality of the treatment looks poor and there is a periapical lesion. The patient presented to the clinic three days after the root canal treatment complaining of severe pain.	Treatment	85.2% <sub>a</sub>	84.0% <sub>a,b</sub>	65.4% <sub>b</sub>	91.7% <sub>a</sub>
	Medication	62.3% <sub>a</sub>	82.0% <sub>a,c</sub>	37.7% <sub>b</sub>	86.7% <sub>c</sub>
Case 8: Primary root canal treatment was done for tooth #46, quality of the treatment looks poor and there is a periapical lesion. The patient	Treatment	45.1% <sub>a</sub>	74.0% <sub>b</sub>	40.3% <sub>a</sub>	71.7% <sub>b</sub>
	Medication	61.5% <sub>a</sub>	64.0% <sub>a</sub>	73.0% <sub>a</sub>	68.3% <sub>a</sub>

presented to the clinic three days after the root canal treatment complaining of severe pain and diffuse swelling.					
<p>Note: Values in the same row and subtable not sharing the same subscript are significantly different at <math>p &lt; .05</math> in the two-sided test of equality for column proportions. Cells with no subscript are not included in the test. Tests assume equal variances.<sup>1</sup></p> <p>1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.</p>					

#### 4. DISCUSSION

A study conducted in 2016 reported that flare-ups associated with endodontic treatment occurs in about 8.5% of cases (Gbadebo et al., 2016). Management of such flare-up cases includes re-instrumentation, cortical trephination, incision and drainage, intracanal medication, occlusal reduction, antibiotics, and non-narcotic analgesics (Jayakodi et al., 2012). Post-obturation flare-ups might confuse practitioners to advocate the need of root canal retreatment even when the primary root canal treatment was optimal, or to prescribe antibiotics without an indication. This unnecessary treatment both wastes the practitioners time and also subjects the patients to the risks involved with such procedures. The study's aim was to compare endodontic decision making for post-obturation flare-up among dental students, post graduate trainees, general practitioners, and endodontists.

Traditionally, research in decision-making of endodontic cases followed a '5-standard answers' scheme to a case scenario (Reit et al., 1985; Kvist et al., 1994; Dechouniotis et al., 2010). In the current study, we added another two options for the practitioners to choose from, namely, 'non-surgical retreatment in addition to incision and drainage', and 'non-surgical retreatment and apical surgery'. This addition was done to add more layers to the evaluation process and decision making in such cases. Furthermore, only radiographs of cases with flare-up after root canal obturation were selected for this study. This helped exclude the option of intracanal medication, which would open up an array of different treatment options in the minds of the practitioners. Generally, research on decision making is limited to this specific topic and might be a reflection of various approaches used by different leading schools and textbooks in the field of Endodontics. In this research, the main references were Cohen's Pathways of the Pulp and Torabinejad's Endodontics: Principles and Practice (Berman and Hargreaves, 2010; Torabinejad et al., 2014).

In this study, it was shown that there is a statistically significant association between the education level and correct treatment ( $p=0.008$ ) and medication ( $P=0.001$ ) scores, indicating that the more educated a practitioner is, the more likely they are to diagnose and treat a flare-up correctly. There was no statistically significant correlation seen between the correct responses and the other variables of gender, age, nationality, or years of experience. This finding was in concurrence with a similar study, where they reported that decision making was not affected by gender, age, or location of the practice in deciding to retreat or to extract (Aryanpour et al., 2000). This finding draws a positive co-relation between decision making and specialization in the field of Endodontics. Although in this study endodontists were the better decision maker, another study has reported that the post-graduate endodontic residents proved to make better decisions (Dechouniotis et al., 2010). Experience is another factor that people might judge a dentist's performance by, although this might not always be truth. The results of this study demonstrated that the performance of undergraduate students in decision making were better than general practitioners (table 7).

When assessing the preferred treatment procedures for the case scenarios with poor obturations, relatively high number of correct responses were observed, in the following order; Case 1 (82.6%), Case 5 (82.6%), Case 6 (79.3%), and Case 7 (78%). On the other hand, Cases with good obturation quality showed the least number of correct answers, in an ascending order of Case 4 (44.2%), Case 8 (50.9%), Case 2 (51.2%), and Case 3 (59.6%). This clearly indicates that when there is a flare-up on a tooth with good obturation quality, a good number of practitioners show confusion towards choosing the right course of treatment. This confusion may lead to unnecessary treatment procedures and expose the patient to the risks involved with them. It was also seen that General Practitioners were among the highest percent (75%) of all other education levels to opt for extraction of teeth over a more conservative option. Earlier reports have shown that success rates of endodontic retreatment are nearly the same as the survival rate for implants (Iqbal and Kim, 2007).

Long-term studies have also shown that the success rate of non-surgical retreatment in teeth with/without periapical lesions was 81-86% (Farzaneh et al., 2004; Imura et al., 2007). Lack of knowledge about these high success rates might explain the tendency of General Practitioners to choose extraction over retreatment. It should not be forgotten that patients may also influence the General

Practitioners decision as they may believe that endodontic retreatment could prove unsuccessful again (Iqbal and Kim, 2008; Hamedy et al., 2013). This could be clubbed with the recent awareness in the advancements of implant dentistry and the accessibility to it (Zitzmann et al., 2009; Voza et al., 2013). Spreading awareness about the success of endodontic retreatment among General practitioners through Continuing Dental Education programs is paramount.

Regarding the type of medication prescribed in each case, it was observed that although most of the respondents gave the correct answer, there was a sizeable percentage of respondents who prescribed antibiotics when they were not needed, e.g., for Case 3 (32.2%) and for Case 7 (26.3%), both of which had only periapical lesion without diffuse swelling. This finding is in concurrence with other studies which displayed the lack of knowledge in prescribing antibiotics. A study conducted in private centers at Al Madinah, Saudi Arabia reported that antibiotic prescription rate for cases of acute apical abscess was 83.3%, wherein the appropriate management of those cases was incision and drainage, non-surgical root canal treatment, or extraction without antibiotic prescription (Al Rahabi and Abuong, 2017). Another study in the north of Saudi Arabia reported a similar finding of an unjustified over-use of antibiotics (Iqbal, 2015). The current study also showed that some respondents failed to prescribe antibiotics when they were indicated, e.g., for Case 2 (26.3%), Case 4 (22.2%), and Case 8 (26.6%), all of which had diffuse swellings (Table 3). These findings clearly show that some dental practitioners lack the knowledge about the antibiotic prescription guidelines.

Evaluating the decision making of participants using radiographic-based clinical scenarios is a common approach has been used previously in studies about root canal treated teeth (Çiçek et al., 2016; Taha et al., 2019). Although using radiographs in these types of studies is important to obtain the correct decision, it has the limitation of being two-dimensional images of a three-dimensional structures and may contribute to considerable inter-observer and intra-observer variability (Goldman et al., 1974). Another limitation was the varying tooth types (single rooted or multirooted canals) which might cause confusion among some of the practitioners.

This study's results emphasize the need for more endodontic courses and lectures directed towards General Practitioners and the importance of training undergraduate students on decision making in Endodontics, with the additional implementation of the guidelines for prescription of antibiotics.

## 5. CONCLUSION

Endodontists and postgraduate residents in endodontics were more conservative in their decision making than undergraduate students and general practitioners. Based on these results it can be recommended that more Endodontic Continuing Dental Education courses should be made available for general practitioners, and that more attention should be given to on the importance of training undergraduates on more accurate decision making in endodontics.

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### Author contributions

All authors contributed to the research and/or preparation of the manuscript.

### Ethical consideration

This study was approved by the ethical committee Institutional Review Board (IRB) of Riyadh Elm University (IRB approval number: SRS/2020/5/206/202).

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### Conflict of interest

The authors declare that they have no conflict of interest.

### Data and materials availability

All data associated with this study are presented in the paper.



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