

## POSTOPERATIVE PAIN FOLLOWING ENDODONTIC PROCEDURES BY AN UNDERGRADUATE STUDENT.

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### Abstract:

**Aim:** The aim of this study was to assess the incidence and severity of post-endodontic pain (PEP) in patients treated by an undergraduate student. The study was a prospective randomized controlled trial conducted at Qassim University Dental College.

**Methodology:** A total of 100 patients were enrolled in the study. The PEP was assessed after 6 hours, 24 hours, 48 hours, and 96 hours using the visual analog scale (VAS) to record the pain from 0 to 10 : 0, no pain, 1-3 mild pain, 3-7 moderate pain, and 7-10 severe pain.

**Results:** showed that post-operative pain incidence was common after six hours (41%) but mostly subsided after the 4th day. The severity of the pain was higher in females than males (p-value=0.001 after 6 hrs; p value=0.000 after 24 hrs). There was no significant difference in the severity of pain in comparison to different apical conditions of the teeth at 6 h, 24 h & 48 hrs, 72 hrs & 96 hrs.

**Conclusion:** the experience of postoperative discomfort following root canal treatment is inherently subjective and can be modified by various circumstances. The incorporation of pain management into dental therapy is crucial, especially during the early phases, in order to mitigate the potential worsening of symptoms.

**Keywords:** Endodontic pain, post operative pain, perception, undergraduate student

### 1. Introduction

Pain is defined by the task force of taxonomy of the International Association for Study of Pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage"(1) Pain is not an uncommon experience in endodontic patients, be it before treatment or post treatment. The prevention and control of postendodontic pain (PEP) constitutes a crucial component of endodontic treatment. The provision of information to patients regarding anticipated postendodontic pain (PEP) and the prescription of appropriate drugs for its management have the potential to enhance patients' trust in their dentists, augment their pain tolerance, and foster a more positive disposition towards subsequent dental procedures.(2,3)



Based on previously published data, it has been observed that pulp therapy and root canal treatment (RCT) tend to result in a higher incidence and intensity of postoperative discomfort compared to other dental operational treatments. (4) In addition to this, studies have also shown the postoperative pain levels and prevalence in endodontic patients in the range of 3% to 58%. (5)

Endodontic treatment is a frequently performed technique that seeks to maintain the integrity of the tooth through the management of dental pulp and periradicular ailments. (6) Hence, the inclusion of endodontics in the curriculum of dental training institutions holds significant importance. The field of undergraduate endodontic education has achieved notable progress in the adoption of educational methodologies pertaining to knowledge acquisition, technical skills, and material utilisation. The aforementioned advancements have significantly enhanced the diagnostic and therapeutic capabilities of dental students in relation to pulpal and periradicular illnesses. (7)

The degree of pain experienced by patients following endodontic treatment performed by undergraduate dental students is an important aspect to consider. The degree of pain may exhibit variability contingent upon several elements, encompassing the intricacy of the case, the proficiency and expertise of the undergraduate student, and the unique pain tolerance of the specific patient. In certain instances, individuals may encounter slight discomfort, however in alternative instances, the level of pain experienced may be more pronounced.

Several factors can contribute to postoperative pain experienced by patients following endodontic treatment. Inflammation is the body's natural response to injury or irritation from mechanical, chemical, and/or microbial injury. (8) Patient-related factors, such as patients with high anxiety levels or lower pain thresholds, may experience increased pain. Patients' characteristics, such as age and gender, may increase pain incidence. (9)

Postoperative discomfort is a prevalent occurrence that can, at times, be inevitable. In order to effectively address pain management, it is imperative to consistently communicate to the patient that they may experience varying degrees of discomfort subsequent to the operation. Moreover, pain medications & analgesics, such as ibuprofen (600 mg), ketoprofen (50 mg), and naproxen (500 mg), may help in curbing the symptoms. (10)

There have been several studies done to assess the PEP in patients treated by students, but there are a dearth of such studies evaluating pain in patients treated by undergraduates in Saudi Arabia. Hence the aim of the current study is to assess the incidence and severity of Postoperative pain following endodontic procedures by an undergraduate student.

## **2. Material and method:**

### **2.1 Study Population:**

The present study was a prospective randomized controlled trial study performed at Qassim University Dental College. All clinical procedures in the present study were approved by the Ethics Committee of Qassim university dental college.

### **2.2 Sample size calculation and estimation:**

Sample size estimation was performed based on a type I error ( $\alpha$ ) of 0.05 and a power set at 90% indicating a total sample of 100 participants. The sample size was calculated based on a type I error of 0.05 with power = 0.8,

indicating that 55 patients would be required in each group to detect an absolute difference of 20% between the groups.

### **2.3 Inclusion criteria:**

- 1) Patients from Qassim University Dental College treated by an undergraduate student from the college.
- 2) Patients 18 years or above requiring endodontic treatment.
- 3) Patients who require non-surgical root canal therapy.
- 4) Treatment performed in single and multiple sessions
- 5) Patients who may have used analgesics before or after the treatment.

### **2.4 Exclusion Criteria:**

- 1) Patients not reported to Qassim University Dental College.
- 2) Patients with ASA III/IV.
- 3) Pregnant women.

### **2.5 Procedure of the study:**

- 100 patients requiring endodontic treatment (Vital teeth, necrotic pulp, or vital pulp that had been treated for symptomatic irreversible pulpitis, or who received retreatment of the root canal).
- Before initiating treatment, each tooth was scored according to a structured questionnaire accessed to age, gender, tooth location, pulpal diagnosis, and number of visits (single or multiple)
- Each patient was treated with the standard procedure including for diagnosis cold pulp sensitivity and a positive response to the electric pulp tester was considered. The patients received cartridges of 2% lidocaine with 1: 80 000 epinephrine in case the patient felt pain into periodontal ligament or intrapulpal injections were employed as supplementary anesthetic techniques. including rubber dam isolation, removal caries, and the working lengths were determined by apex locator and periapical radiographs 1 mm from the apexes. Step-back preparation was performed on each canal by hand files. Irrigation was performed with 2.5% NaOCl and In between the visit the root canals were medicated with calcium hydroxide, the teeth were then closed with a sterile dry cotton pellet, and temporary restorative and no systemic medication was prescribed, and the patients were instructed to take mild analgesics if they experienced pain and at the end of the procedure, the root canals were dried with paper points and then filled with gutta-percha using the cold lateral condensation technique.
- The presence of postoperative pain was assessed 6 hours, 1day, and 2day, and 3day, and 4 days using the visual analog scale (VAS) to record the pain from 0 to 10 : 0, no pain, 1-3mild pain, 3-7 moderate pain; 7-10 sever pain.

### **2.6 Statistical Analysis:**

The independent student's *t*-test and one- or two-way variance test were used to compare the continuous variables between groups. Chi-square was used to compare frequencies of categorical variables. Differences were considered significant when probabilities were less than 0.05.

## **3. RESULTS**

### **3.1 Patient distribution & assessment:**

Taking into consideration the inclusion and the exclusion criteria, 100 patients were enrolled in the study to assess the incidence and severity of PEP. The patient distribution was according to the age, gender, tooth area, pulpal condition and peri-apical condition of the tooth.

The post-operative pain was assessed after 6 hours, after 24 hours, after 48 hours and after 96 hours.

### **3.2 Incidence & Severity of PEP:**

After 6 hours: 59% of the patients felt no pain while 24% felt mild pain, 14% felt moderate pain, and only 3% felt severe pain after 6h.

After 24 hours: 60% of them had no pain, while 30% felt mild pain, 8% felt moderate pain, and only 2% felt severe pain.

After 48 hours: 87% of patients felt no pain, while 10% felt mild pain, and 3% felt moderate pain.

After 72h 93.9% of the patients felt no pain while 5.1% felt mild pain, and 1% felt moderate pain.

After 96 hours: 98% of the patients felt no pain, while only 2% felt mild pain.

### **3.3 Comparison of PEP in relation to the Gender:**

After 6 hours and after 24 hours: There was a significant difference in the severity of pain in genders; females reported a higher pain intensity than Males (p-value=0.001 after 6 hours; p-value=0.000 after 24 hours).

After 48 hours, 72 hours and 96 hours: There were no significant differences between the genders. (p-value=0.025 after 48 hours; p-value=0.378 after 72 hours; p-value=0.205 after 96 hours).

### **3.4 Comparison of PEP in relation to the Age:**

There was no significant difference in the severity of the pain between all age groups t 6h, 24h, 48h, 72h, and 96h.p-value (0.426) at 6h, (0.803) at 24h, (0.684) at 48, and (0.951) at 72h, and (0.951) at 96 hours.

### **3.5 Comparison of PEP in relation to the teeth involved:**

There was no significant difference in the severity of the pain between the posterior teeth and anterior teeth at 6h, 24h, 48h, 72h, and 96h. (p-value (0.035) at 6h, (0.374) at 24h, (0.787) at 48, and (0.544) at 72h, and (0,932) at 96).

### **3.6 Comparison of PEP in relation to the pulpal condition:**

After 6 hours, 24 hours & 48 hours: There was a significant difference in the severity of the pain, where necrotic pulp cases reported with less pain compared with the tooth with a pulpal condition (p-value (0.012) on 6h and (0.000) after 24h, (0.014) after 48 hrs.

### **3.7 Comparison of PEP in relation to the apical condition:**

There was no significant difference in the severity of the pain in comparison to different apical conditions of the teeth at 6h, 24h, 48h, 72h, and 96h. (p-value (0.100) at 6h, (0.301) at 24h, (0.489) at 48, and (0.0.369) at 72h, and (0.246) at 96 hours).

**TABLE 1:** Patient distribution according to the degree of pain in the study population.

Pain after 6 hours		
	Frequency (Out of 100)	Percent
No pain	60	60.0
Mild pain	30	30.0
Moderate pain	8	8.0
Severe pain	2	2.0
Pain after 24 hours		
No pain	60	60
Mild pain	30	30
Moderate pain	8	8
Severe pain	2	2
Pain after 48 hours		
No pain	87	87.0
Mild pain	10	10.0
Moderate pain	3	3.0
Pain after 72 hours		
No pain	93	93.0
Mild pain	5	5.0
Moderate pain	1	1.0
Pain after 96 hours		
No pain	98	98.0
Mild pain	2	2.0

**TABLE 2:** Gender distribution in the patients according to the pain at different duration and the severity of PEP.

DURATION	DEGREE OF PAIN	GENDER	
		Male	Female
	NO PAIN	76.80%	36.40%
Pain after 6 hours	MILD PAIN	14.30%	36.40%
	MODERATE PAIN	7.10%	22.70%
	SEVERE PAIN	1.80%	4.50%
Pain after 1 day	NO PAIN	78.60%	36.40%
	MILD PAIN	16.10%	47.70%
	MODERATE PAIN	3.60%	13.60%
	SEVERE PAIN	1.80%	2.30%
Pain after 2 days	NO PAIN	94.60%	77.30%

	MILD PAIN	5.40%	15.90%
	MODERATE PAIN	0%	6.80%
	SEVERE PAIN	0%	0%
Pain after 3 days	NO PAIN	100%	95.50%
	MILD PAIN	0%	4.50%
	MODERATE PAIN	0%	0%
	SEVERE PAIN	0%	0%
Pain after 4 days	NO PAIN	96.40%	100%
	MILD PAIN	3.60%	0%
	MODERATE PAIN	0%	0%
	SEVERE PAIN	0%	0%

**TABLE 3: INTENSITY OF PAIN IN PATIENTS DEPENDING ON GENDER, TEETH INVOLVED, PULPAL DIAGNOSIS & APICAL DIAGNOSIS.**

DURATION	Intensity of pain	G e n d e r		Teeth invol ed		Pulpal diagnosis		Apical diagnosis					
		M a l e	F e m a l e	A n t e r i o r	P o s t e r i o r	Sympto matic irreversi ble pulpitis	Asympt omatic irreversi ble pulpitis	Prev ious ly treat ed	Prev iousl y initi ated	Nor mal apica l tissu e	Sympto matic apical periodo ntitis	Asympt omatic apical periodon titis	Chro nic apica l absce ss
PAIN AFTER 6 HOUR S	No pai n	4 3	1 6	3 0	2 9	3	18	4	2	31	8	20	0
	Mil d pai n	8	1 6	1 8	6	4	7	2	2	9	4	11	0

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	Moderate pain	4	10	4	10	6	5	1	1	11	1	1	1
	Severe pain	1	2	1	2	2	1	0	0	1	1	1	0
PAIN AFTER ONE DAY	No pain	44	16	32	28	3	18	4	1	31	8	21	0
	Mild pain	9	21	18	12	7	9	3	3	15	4	10	1
	Moderate pain	2	6	2	6	5	3	0	0	6	2	0	0
	Severe pain	1	1	1	1	0	1	0	1	0	0	2	0
PAIN AFTER TWO DAYS	No pain	53	34	45	42	11	27	7	4	47	10	29	1
	Mild pain	3	7	6	4	1	4	0	1	3	3	4	0

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	Moderate pain	0	3	2	1	3	0	0	0	2	1	0	0
	Severe pain	0	0	0	0	0	0	0	0	0	0	0	0
PAIN AFTER THREE DAYS	No pain	54	40	50	44	13	30	7	5	51	10	32	1
	Mild pain	2	3	2	3	1	1	0	0	0	4	1	0
	Moderate pain	0	1	1	0	1	0	0	0	1	0	0	0
	Severe pain	0	0	0	0	0	0	0	0	0	0	0	0
PAIN AFTER FOUR DAYS	No pain	54	44	46	40	15	31	7	5	52	14	31	1
	Mild	2	0	1	2	0	0	0	0	0	0	2	0



Moderate	0	0	0	0	0	0	0	0	0	0	0	0	0
Severe pain	0	0	0	0	0	0	0	0	0	0	0	0	0

**4. Discussion**

Post-operative endodontic pain is sometimes an inevitable sequela and is varied from patients to patients. The primary objective of this study was to assess the PEP in patients treated by undergraduate students. In the present study, we found that after 6 hours, the majority of patients (59%) reported no pain, with 24% experiencing mild pain, 14% reporting moderate pain, and only 3% reporting severe pain. After 24 hours, 60% of patients had no pain, while 30% experienced mild pain, 8% reported moderate pain, and 2% reported severe pain. At the 48-hour interval, 87% of patients felt no pain, with 10% experiencing mild pain and 3% reporting moderate pain. After 72 hours, 93.9% of patients reported no pain, 5.1% felt mild pain, and 1% experienced moderate pain. Finally, after 96 hours, 98% of patients felt no pain, with only 2% reporting mild pain.

Researchers have reported that gender, tooth type, tooth area, presence or absence of symptoms before treatment, and pulpal status may contribute to an increased risk of pain after root canal treatment(11–13). In the present study, the assessment of PEP in males and females showed that the intensity of pain was more in females compared to males at 6h, and 24h, whereas no significant difference was noted at 48h, 72h, and 96h.

Regarding the influence of gender, several studies have indicated that women exhibit a higher susceptibility to experiencing flare-ups compared to men (11,14–18). However, contrasting findings have been reported, with some studies suggesting no significant association between gender and post-endodontic treatment pain (Ng et al., 2004).

Majority of the studies, including the current study have found that the PEP is more in females than in males. The observed phenomenon can potentially be elucidated by the inherent biological distinctions between genders, which can be attributed to the varying amounts of hormones such as serotonin and non-adrenalin that undergo fluctuations(19,20). The sensation of pain is modulated by the hormone cortisol, which plays a pivotal role in pain regulation. Typically, the quantity excreted in males is more than that in females, as noted by Walton and Fouad (1992) (21)and Mehrvarzfar et al. (2008)(22).

We found no statistically significant results when the PEP was compared in respect to the age, tooth involved, the apical condition at different time spans. Whereas on pulpal condition, there was a significant difference at the 6h,24h,48h, and no significant difference after 72h and 96h.

Post-operative pain was assessed after six-hours to 4th day in the present study. Twelve, 24, and 48 hours postoperative time intervals were chosen in the other studies as well, as most postoperative pain occurs between these time intervals.(23,24)A number of studies reported pain after two hours, four hours, and seven days(25). The reported incidence of pain ranged from 4 [20] to 87 % (23,25,26). The results showed that post-operative

pain incidence was common after six hours (41%) but mostly subsided after the 4th day. This result agrees with the findings of other studies(27–29) that also registered the maximum postoperative pain level six hours after the treatment, when the anaesthetic effect has completely disappeared. In a study by Luis et al., (29) at the first day, the total percentage of patients reporting some pain decreased lightly to 77%. Other studies have reported lower percentages of patients feeling pain after 1 day: Harrison et al.(30) found 38%, Koba et al.(31) reported 34%, and Ng et al.(32) observed 40%. This apparent discordance could be due to the Hawthorne effect(33).

In this study, the RCT was performed by an undergraduate students. In a study conducted by Garcia-Font et al. (2017),(17) it was shown that patients who received treatment from postgraduate students had a notably greater incidence of postoperative discomfort compared to patients treated by undergraduate students ( $P = 0.01$ ). The findings of this study align with the findings of Walton et al.,(11) who observed a notable decrease in post-obturation discomfort among patients treated by undergraduate operators compared to those treated by residents or faculty members. According to them, post-operative pain was significantly higher for patients treated by postgraduate students than those treated by undergraduate students based on the experience level of the clinicians. Other studies found that results differ from those obtained by Wong *et al.*(34) and Glennon *et al.*,(35) who reported that the skill level of clinicians had no significant impact on the incidence of postoperative pain.

Manual versus rotary instruments in the past have indicated that rotary instruments played a role in lower incidence and intensity of postoperative pain than hand files. In this study, manual instrumentation was used which helps an undergraduate student to achieve more efficient root canal preparations and required a simpler learning curve. This difference might be associated with the amount of extrusion debris. In addition, a step-back technique often excretes debris and irrigant through the apical foramen due to a lack of space to remove the debris coronally.(36) In contrast, continuous rotary motion directly removes the debris toward the orifice.

The experience of postoperative discomfort following root canal treatment (RCT) is inherently subjective and can be modified by various circumstances. (8,37–39). The anticipation and effective management of pain are critical components of endodontic therapy. Due to the inherent complexity of subjective variables, many scales and methodologies are employed in the assessment of postoperative pain. The present investigation employed the Huskisson Visual Analogue Scale (VAS)(40), which is a continuous scale that allows for the recording of all intermediate values. This scale is readily comprehensible to patients and possesses qualities of simplicity, validity, and reliability. Moreover, it has been extensively employed in prior research endeavours within the field of endodontics(41–44).

In the present study we did not find significant results in respect to the pulpal status and the post-endodontic pain. The available research presents inconclusive evidence on the impact of pulp status, namely whether it is vital or necrotic, on the occurrence and severity of post-endodontic pain (PEP). Several studies have reported that post-endodontic pain (PEP) is more frequently observed after treating teeth with vital pulp. These studies include Clem(45), Calhoun and Landers(46), Marshal and Liesinger(47), Fox et al.(48).

The incorporation of pain management into dental therapy is crucial, especially during the early phases, in order to mitigate the potential worsening of symptoms. When making the ultimate determination about the prescription of an analgesic, it is imperative to take into account several factors, including but not limited to gender, frequency of treatment sessions, and the patient's previous encounters with pain and analgesic medications.

As our study primarily focused on pain experienced following root canal treatment performed by undergraduate dental students, further studies could compare the incidence and severity of postoperative pain between different treatment modalities, such as comparing the outcomes of root canal treatment performed by undergraduate students versus postgraduate programs.

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