

Evaluation of the Quality of Root Canal Obturation Performed by Periodic Residents and Its Impact on Postoperative Pain using Peri-Apical Radiographs: A Retrospective Cross-Sectional Study

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ABSTRACT

Pain reported by 175 dental patients, examining several features such as gender, tooth position, and the quality of dental fillings (obturation); Patients with overfilling (67%) and underfilling (64%) fillings reported greater discomfort than those with adequately obturated teeth (49%). The most common source of discomfort was the upper molars, particularly the upper first molar. Additionally, female patients expressed slightly more discomfort than their male counterparts. The chi-square test revealed a difference in pain levels between overfilling and underfilling ($p = 0.017$). In conclusion, the results of this study emphasized the importance of good quality obturation in reducing pain and ensuring that patients are comfortable after the dental procedure.

KEYWORDS: Root Canal, Obturation, Postoperative Pain, dental Radiographs

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I. INTRODUCTION

Title a Mastering root canal therapy is vital today because it provides a solid foundation for later procedures such as intra-radicular post-placement and crown and bridge preparation. This technique helps the surrounding tissues recover and prevents reinfection. Both dental students and graduate residents must be proficient in all aspects of restorative dentistry because it is a critical field component. Given the increasing demand for procedures that allow patients to retain their natural teethⁱ.

Following the cleaning and shaping process, the primary objective of filling the root canal system is to seal the area from bacteria and fluids, while adequately filling the entire channel, which includes the main canal, dentinal tubules, and any accessory canals. This procedure aims to eliminate any empty spaces from the top (coronal) to the bottom (apical) and to maintain the cleanliness achieved during the preparation phaseⁱⁱ.

Some studies indicate that the technical quality of the root canal filling is the primary cause of root canal treatment failure (RCT). The success or result of the endodontic procedure is primarily determined by this attributeⁱⁱⁱ.

RCT success can be evaluated using histological, radiological, and clinical techniques^{iv}. The precision and accuracy of root canal fillings are often assessed using radiographic methods^v.

xray offers a simple, trustworthy, and impartial way to assess the caliber of root canal fillings. Root fillings that extend more than 2 mm from the apex, extrusions into periapical tissues, and gaps along the canal walls or inside the filling as a result of a poor seal are examples of procedural errors that can be seen on radiographs and impact quality^{vi}.

Following certain parameters, evaluating the technical quality of root canal fillings is one way to gauge how well endodontic training and practice are working. This method has been used in numerous studies to evaluate the proficiency and abilities of general practitioners, endodontic experts, and undergraduate students.^{vii} However, the evaluation of postgraduate students is less commonly reported in many countries.

According to Donnelly et al., improving clinical performance is dependent on several variables, including training, technology utilization, and better or modified teaching strategies xray offers a simple, trustworthy, and impartial

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According to Donnelly et al., improving clinical performance is dependent on several variables, including training, technology utilization, and better or modified teaching strategies egies. Therefore, continuing education at the undergraduate and graduate levels is essential to enhancing clinical practice. Enhancing training and treatment results also requires auditing present teaching and practice^x.

I. THE PURPOSE OF THIS STUDY IS TO EXAMINE THE QUALITY OF ROOT CANAL FILLINGS PERFORMED BY POSTGRADUATE RESIDENT DENTISTS IN ORDER TO GAUGE HOW WELL THEIR ENDODONTIC CLINICAL TRAINING WENT. THE OBJECTIVE IS TO PRODUCE KNOWLEDGEABLE AND CAPABLE TRAINERS WHO CAN DELIVER TOP-NOTCH CARE. FURTHERMORE, THE RESULTS COULD AID IN DEVELOPING A MORE EFFECTIVE PROGRAM THAT SIGNIFICANTLY DECREASES THE FREQUENCY OF UNFAVORABLE CLINICAL OUTCOMES ASSOCIATED WITH POOR ROOT CANAL MATERIALS AND METHODS

II. MATERIALS AND METHODS

A. Study Design
B. This retrospective cross-sectional study involved 174 patients who received root canal treatment at the Al Maghreb Specialized Dental Center, Ministry of Health. Ethical approval for this study was obtained from the Baghdad Health Directorate-Al-Rusafa, ensuring all procedures wereData Collection

- Data were collected through patient interviews two weeks after the obturation step Periapical radiographs were taken after obturation to evaluate the quality of the root canal filling.
- . Information gathered included:
 - Presence of pain (Yes/No)
 - Patient demographics: age and gender
 - Quality of obturation: overfilled, underfilled, or optimally filled

Table 1: Pain vs. Obturation Type

Obturation Type	Pain (Yes)	Pain (No)	Total	Percentage with Pain
Under	66	37	103	64%
Over	12	6	18	67%

C. Radiographic Evaluation
Periapical radiographs were taken after obturation to evaluate the quality of the root canal filling.
conducted by ethical standards. Informed consent was secured from all participating patients before sample collection. Samples were collected over a designated period, from October 13, 2024, to January 13, 2025.

D. Patient Selection
The patients included in the study were treated by residents and supervised by specialist dentist in endodntics, and their root canal treatments were performed over multiple visits, typically three.

E. Instrumentation and Irrigation Protocol
The instrumentation and irrigation protocol were standardized for all cases:

- **Instrumentation:** Rotary files were used for canal preparation.
- **Irrigation:** Sodium hypochlorite and normal saline were used for irrigation.

Sealer: Bio sealer was used in all cases
The following factors were taken into account in this study: tooth type; recognized canals; operator; length of root filling in each identified root canal; and root filling density. A root filling was considered to be of acceptable quality if its length was between 0 and 2 mm from the radiography apex and if its density was uniform, free of both internal and external voids between the filling and the canal wall. The radiographs were evaluated using previously acceptable Standards^{xi}

A. Length of Root Canal Filling
Sufficient: The root canal filling is considered adequate if its terminus is at or within 2 mm of the radiographic apex.
insufficient: The filling is deemed insufficient if it either extends beyond the radiographic apex or falls short by more than 2 mm from the apex.

III. RESULTS
A. Demographic Data
The study included 175 patients with the following characteristics:

- **Gender Distribution:** 103 males (59%) and 72 females (41%).
- **Age Distribution:** The participants' ages ranged from 13 to 76 years, with a mean age of 33 years.

B. Pain vs. Obturation Type
The relationship between pain and different obturation types is summarized in Table 1. The highest percentage of pain was associated with over-obturation (67%), followed closely by under-obturation (64%) and both obturation (64%). Fit obturation showed the lowest percentage of pain (49%).

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Fit	19	20	39	49%
Both	7	4	11	64%

A. Pain vs. Tooth Number and Position

The relationship between tooth number, position (upper or lower), and pain is presented in Table 2. Tooth number 6

(Upper) showed the highest percentage of pain (80%), followed by tooth number 5 (Upper) with 74% and tooth number 6 (Lower) with 68%.

Table 2: Pain vs. Tooth Number and Position

Tooth Number	Tooth Position	Pain (Yes)	Pain (No)	Total	Percentage with Pain
1	Upper	4	5	9	44%
2	Upper	3	3	6	50%
3	Upper	1	2	3	33%
4	Upper	5	6	11	45%
5	Upper	14	5	19	74%
5	Lower	4	4	8	50%
6	Upper	12	3	15	80%
6	Lower	17	8	25	68%
7	Upper	5	3	8	63%
7	Lower	6	5	11	55%

Pain vs. Gender

The relationship between gender and pain is summarized in Table 3. The data indicates that females experience a slightly

higher percentage of pain (58.88%) compared to males (55.34%).

Table 3: Pain vs. Gender

Gender	Pain (Yes)	Pain (No)	Total	Percentage with Pain
Male	57	46	103	55.34%
Female	63	44	107	58.88%

B. Chi-Square Test for Obturation Types

The significance of the difference in pain occurrence between excess and under-obturation was assessed using a chi-square

test. With one degree of freedom, the chi-square statistic was 5.7, resulting in a p-value of 0.017. There is a substantial difference between over- and under-obturation regarding pain, as indicated by the p-value being less than 0.05.

Table 4: Chi-Square Test Results

Obturation Type	Pain (Yes)	Pain (No)	Total
Under	66	37	103
Over	12	6	18

IV. DISCUSSION

The purpose of this study was to assess the influence of gender, teeth number, and position on the types of obturation on the incidence of post-operative discomfort. Pain is a parameter involved with problems degenerated with parameters like sex, number of teeth, and type of obturation. These insights provide helpful information about the variables influencing postoperative pain in patients after dental procedures.

A. Pain and Obturation Type

The findings of this study underscore the critical importance of adequate training for medical interns and residents in performing root canal treatments and achieving proper obturation. The prevalence of post-operative pain associated

with both over-obturation (67%) and under-obturation (64%) highlights potential deficiencies in the technical skills and judgment of trainees. Conversely, the lower incidence of pain (49%) with correctly fitted obturations emphasizes the positive impact of precise technique, which should be a primary focus of training programs.

These results align with existing literature indicating that over-obturation, in particular, can lead to postoperative pain due to the potential overextension of filling material or a compromised apical seal (Lovelace et al., 2019)^{xii}.

Inflammation and pain can occur from over-obturation, which puts higher stress on the surrounding tissues (Muller et al., 2020)^{xiii}. In contrast, properly fitted obturations minimize

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the chance of discomfort and offer the best sealing, thus they are less prone to cause such problems (Siqueira et al., 2018)^{xiv}

Pain and Tooth Number and Position

B. The correlation between tooth number and position with post-operative pain also presents important implications for training. The highest reported discomfort (80%) associated with upper first molars (tooth upper 6) and the significant discomfort with upper second premolars (tooth upper 5) at 74%, followed by lower molars (tooth lower 6 and tooth lower 7) at 68%, suggests that procedures on teeth with complex root anatomies, particularly in the maxillary arch, may pose a greater challenge for trainees. Prior research supports this, indicating that the intricate root systems of maxillary molars are more prone to postoperative complications (Nusstein et al., 2017)^{xv}.

C. This complexity increases the likelihood of errors during obturation by less experienced practitioners. The physical and physiological variations between the maxillary and mandibular areas, resulting in greater susceptibility in maxillary molars, further emphasize the need for focused training on managing these specific cases (Ng et al., 2011)^{xvi}

It is critical to explore how these obturation faults (shortage or overfillings) were detected in the context of trainee performance. Were these errors predominantly noticed through patient-reported symptoms, or were they discovered through normal post-operative radiographs checked by trainees or supervising dentists? If symptoms were the major indicator, what specific complaints did patients report? Furthermore, were these symptoms the predictable result of the reported obturation problems, or did they appear unexpectedly? Understanding the regularity of these symptoms is critical to improving trainee education in identifying potential problems.

D. Pain and Gender Differences

Gender should be highlighted as a variable due to its potential impact on the perception of pain, even when it is observed that the occurrence rates of pain across genders were not significantly different. Females experienced slightly higher pain in approximately (58.88%) as compared to males who as experienced (55.34%). This evidence supports previous studies that state females are more likely to report pain complaints after dental work, and this may be as a result of hormonal factors, psychologically, or both (Linton, 2018^{xvii}; Fillingim et al., 2009^{xviii}). However, the study in question only reported a small difference, thus there is need for congruous studies to be carried out in order to fully understand areas like how gender effects treatment in terms of pain felt by the patient in the case of dental treatment post surgery.

Statistical Significance of Obturation Types

Through chi-square analysis it was evident that there was a marked difference in the pain levels reported when comparing over-obturation and under-obturation techniques (

$p = 0.017$). Making it effective during the performance of the treatment to report the correct full response format, all forms of reporting the correct clip show the need to use the proper obturation technique in order to relieve the patient post treatment. Clinicians should be made aware of the dangers of over-obturation, as over used filling material could push way too much pressure which then leads to the patient's suffering from pain in the apical periodontitis (Muller et al., 2020)¹¹.

LIMITATIONS AND FUTURE DIRECTIONS

The study's limitations, such as the sample size and lack of precise demographic stratification, should be taken into account when interpreting the results. Future studies with bigger and more diverse populations should look into other important aspects such as pain duration, analgesic use, and patient satisfaction. Furthermore, more research is needed to determine the particular processes by which distinct obturation types affect post-operative discomfort.

Future research can significantly improve endodontic treatment outcomes and reduce post-operative discomfort for patients by focusing on intern and resident training, as well as thoroughly analyzing the detection methods and nature of patient-reported symptoms following obturation errors.

CONCLUSION

Furthermore, studies indicate that dental patients are likely to experience greater discomfort if the root canal obturation is performed inadequately, such as in cases involving the extrusion of excess filling material. Research has also highlighted that patient gender and the position of the treated tooth can contribute to post-treatment pain levels. These findings strongly emphasize the critical importance of employing proper and meticulous obturation techniques. Moreover, they underscore the necessity of considering factors like the number of treated teeth and their specific position within the oral cavity when predicting potential pain outcomes following the procedure. A comprehensive understanding of these variables can aid clinicians in implementing preventive strategies to minimize post-operative pain and enhance the overall patient experience.

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