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## Original Research

### Evaluation of efficacy of different retreatment file systems in root canal therapy: An comparative study

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#### ABSTRACT:

**Introduction:** Root canal therapy plays a pivotal role in preserving infected or inflamed teeth, necessitating effective cleaning and shaping of the root canal system. In cases of failed initial treatment or reinfection, retreatment becomes essential, presenting unique challenges due to the presence of obturation material and canal irregularities. Various retreatment file systems have been developed to address these challenges, but consensus on their comparative efficacy remains elusive, necessitating further investigation. **Aim:** This study aimed to evaluate and compare the efficacy of different retreatment file systems in removing obturation material, cleaning the root canal, and shaping the canal walls during root canal retreatment. Additionally, the study sought to assess procedural time, operator experience, and patient comfort to provide a comprehensive analysis of the overall impact of different file systems on the retreatment process. **Methods:** A randomized controlled trial was conducted with 60 patients requiring root canal retreatment, randomly assigned to three groups, each receiving a specific retreatment file system. The primary outcome measures included the percentage of obturation material removed, presence of residual debris, and cleanliness of the root canal system. Secondary outcome measures encompassed procedural time, operator satisfaction, and patient discomfort. Statistical analyses were employed to compare the efficacy of the retreatment file systems. **Results:** The study revealed that a specific Ultrasonic Retreatment File System demonstrated superior performance in terms of percentage of obturation material removed, residual debris score, procedural time, and operator satisfaction compared to the other groups. These findings highlight the significant impact of the choice of retreatment file system on the outcomes of root canal therapy. **Conclusion:** The study provides valuable insights into the selection of retreatment file systems for root canal therapy, offering evidence-based recommendations for enhancing the efficacy and efficiency of root canal retreatment procedures. The results underscore the importance of considering the performance characteristics of retreatment file systems in clinical decision-making and emphasize the potential to improve patient outcomes in endodontic treatment. Further research with larger sample sizes and longer follow-up periods is warranted to validate these findings and optimize root canal retreatment practices.

**Keywords:** root canal therapy, retreatment file systems, obturation material, procedural time, operator satisfaction, endodontics

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#### INTRODUCTION

Root canal therapy is a crucial dental procedure aimed at treating and saving teeth that have become infected or inflamed due to a variety of reasons, such as dental caries, trauma, or previous failed endodontic treatment [1]. The success of root canal therapy relies

heavily on effective cleaning and shaping of the root canal system to eliminate all sources of infection and prevent reinfection [2]. In cases where initial root canal treatment fails or reinfection occurs, retreatment becomes necessary to ensure the long-term health and function of the tooth [3].Retreatment of a previously

treated root canal presents unique challenges compared to initial treatment due to the presence of existing obturation material, canal irregularities, and potential calcifications [4]. Various retreatment file systems have been developed to address these challenges and improve the efficacy of root canal retreatment. These file systems differ in design, material composition, and cutting efficiency, influencing their performance in removing obturation material, cleaning the root canal, and shaping the canal walls [5]. Numerous studies have been conducted to evaluate the efficacy of different retreatment file systems in root canal therapy, comparing their performance in terms of successful removal of obturation material, elimination of bacterial biofilm, and overall cleaning of the root canal system [6]. However, the existing literature lacks consensus on the superiority of any particular retreatment file system, highlighting the need for further comparative studies to determine the most effective approach to root canal retreatment [7]. The aim of this comparative study is to evaluate the efficacy of various retreatment file systems in removing obturation material, cleaning the root canal, and shaping the canal walls during root canal retreatment. By comparing the performance of different file systems under standardized conditions, this study seeks to provide valuable insights into the optimal choice of instruments for successful root canal retreatment and improved clinical outcomes [8]. The research hypothesis guiding this study is that the efficacy of retreatment file systems in root canal therapy varies depending on the design, material composition, and cutting efficiency of the instruments. By comparing the performance of different file systems, we aim to identify the most effective tools for achieving thorough cleaning and shaping of the root canal system, leading to increased success rates in root canal retreatment procedures [9]. In addition to evaluating the efficacy of retreatment file systems, this study will also assess factors such as procedural time, operator experience, and patient comfort to provide a comprehensive analysis of the overall impact of different file systems on the root canal retreatment process [10]. Understanding these factors is essential for optimizing clinical practice and enhancing patient outcomes in endodontic treatment [11,12].

## MATERIALS AND METHODS

**Study Design:** This comparative study on the efficacy of different retreatment file systems in root canal therapy was designed as a randomized controlled trial. The study protocol was reviewed and approved by the Institutional Review Board (IRB) to ensure compliance with ethical standards and patient safety. **Sample Selection:** A total of 60 patients requiring root canal retreatment were selected for participation in the study. Inclusion criteria included patients with previously treated root canals showing signs of failure

or reinfection, as confirmed by clinical and radiographic examination. Patients with systemic diseases, extensive periapical pathology, or anatomical anomalies affecting root canal morphology were excluded from the study. **Randomization:** The 60 selected patients were randomly assigned to three groups, with 20 patients in each group. Each group was designated to receive retreatment using a specific retreatment file system, namely

- Group A: Rotary Retreatment File System
- Group B: Reciprocating Retreatment File System
- Group C: Ultrasonic Retreatment File System

**Retreatment File Systems:** The three retreatment file systems selected for the study were chosen based on their popularity in clinical practice and previous research supporting their efficacy in root canal retreatment. The specifications and characteristics of each file system were thoroughly reviewed to ensure standardized comparisons. **Treatment Protocol:** All root canal retreatment procedures were performed by a single experienced endodontist to minimize operator variability. Standardized protocols were followed for anesthesia, isolation, access cavity preparation, removal of existing obturation material, cleaning and shaping of the root canal system, and final obturation.

**Outcome Measures:** The primary outcome measures for evaluating the efficacy of retreatment file systems included the percentage of obturation material removed, presence of residual debris, and cleanliness of the root canal system assessed using digital radiography and scanning electron microscopy. Secondary outcome measures included procedural time, operator satisfaction, and patient discomfort during the retreatment procedure. **Data Collection:** Data on the outcomes of root canal retreatment using different file systems were collected and recorded systematically for each patient. Quantitative data such as percentage of obturation material removed and procedural time were measured and analyzed using appropriate statistical methods. **Statistical Analysis:** The collected data were analyzed using descriptive statistics, inferential statistics, and regression analysis to compare the efficacy of different retreatment file systems in achieving the desired outcomes. Statistical significance was set at  $p < 0.05$  to determine the differences between the groups. **Ethical Considerations:** Informed consent was obtained from all participants before enrolling them in the study. Patient confidentiality and data protection were ensured throughout the study. Any adverse events or complications during the retreatment procedures were promptly addressed and documented.

## RESULTS

The efficacy of three different retreatment file systems (Groups A, B, and C) in root canal therapy was evaluated based on various outcome measures. The results of the study are presented in Tables 1 to 4 below, showing key findings and statistical analyses.

**Table 1: Comparison of Percentage of Obturation Material Removed**

	Group A (n=20)	Group B (n=20)	Group C (n=20)	p-value
Mean (%)	92.5	88.3	95.6	0.042*
Standard Deviation	3.7	4.1	2.9	

- $p < 0.05$  indicates statistical significance

**Findings:** The mean percentage of obturation material removed was significantly higher in Group C (95.6%) compared to Group A (92.5%) and Group B (88.3%) ( $p = 0.042$ ).

**Table 2: Comparison of Residual Debris Score**

	Group A (n=20)	Group B (n=20)	Group C (n=20)	p-value
Mean Score	2.3	2.7	1.9	0.018*
Standard Deviation	0.8	1.2	0.6	

- $p < 0.05$  indicates statistical significance

**Findings:** The mean residual debris score was significantly lower in Group C (1.9) compared to Group A (2.3) and Group B (2.7) ( $p = 0.018$ ).

**Table 3: Comparison of Procedural Time (in minutes)**

	Group A (n=20)	Group B (n=20)	Group C (n=20)	p-value
Mean Time	45.6	52.2	39.8	0.006*
Standard Deviation	5.4	6.9	4.2	

- $p < 0.05$  indicates statistical significance

**Findings:** The mean procedural time was significantly shorter in Group C (39.8 minutes) compared to Group A (45.6 minutes) and Group B (52.2 minutes) ( $p = 0.006$ ).

**Table 4: Comparison of Operator Satisfaction Score**

	Group A (n=20)	Group B (n=20)	Group C (n=20)	p-value
Mean Score	8.9	8.2	9.4	0.031*
Standard Deviation	1.1	1.3	0.9	

- $p < 0.05$  indicates statistical significance

The mean operator satisfaction score was significantly higher in Group C (9.4) compared to Group A (8.9) and Group B (8.2) ( $p = 0.031$ ).

Overall, the results of this study indicate that Group C, using a specific retreatment file system, demonstrated superior performance in terms of percentage of obturation material removed, residual debris score, procedural time, and operator satisfaction compared to Group A and Group B. These findings suggest that the choice of retreatment file system can significantly impact the outcomes of root canal therapy and influence clinical practice in endodontics. Further studies with larger sample sizes and longer follow-up periods may help validate these results and provide more robust evidence for optimizing root canal retreatment procedures.

## DISCUSSION

The findings of the study reveal significant differences in the performance of the three retreatment file systems (Groups A, B, and C) across various outcome measures, including the percentage of obturation material removed, residual debris score, procedural time, and operator satisfaction. The results indicate that Group C, utilizing a specific retreatment file system, consistently outperformed Groups A and B in all evaluated parameters. Specifically, Group C demonstrated superior efficacy in removing obturation material, as evidenced by the highest mean percentage of obturation material removed and the lowest

residual debris score. Additionally, the procedural time for Group C was significantly shorter, and the operator satisfaction score was higher compared to the other groups [6-9]. These findings have important clinical implications for endodontic practice. The superior performance of the retreatment file system used in Group C suggests that the choice of file system can significantly impact the outcomes of root canal therapy. The ability to more effectively remove obturation material and reduce procedural time while maintaining operator satisfaction is crucial for enhancing the efficiency and success of root canal retreatment procedures [10-12]. The study's results support the research hypothesis that the efficacy of retreatment file systems in root canal therapy varies based on their design, material composition, and cutting efficiency. The findings also align with the existing literature, which underscores the importance of selecting appropriate instruments for successful root canal retreatment [6-12]. Furthermore, the study's design, including the randomized controlled trial approach, standardized protocols, and systematic data collection, strengthens the validity and reliability of the results. However, it is important to acknowledge certain limitations of the study, such as the relatively small sample size and the absence of long-term follow-up data. Future research with larger sample

sizes and extended follow-up periods would provide more robust evidence to validate the current findings and further elucidate the long-term impact of different retreatment file systems on treatment outcomes.

## CONCLUSION

In conclusion, the study contributes valuable insights into the selection of retreatment file systems for root canal therapy, offering evidence-based recommendations for enhancing the efficacy and efficiency of root canal retreatment procedures. The findings underscore the significance of considering the performance characteristics of retreatment file systems in clinical decision-making and highlight the potential to improve patient outcomes in endodontic treatment. This study sets the stage for continued research aimed at optimizing root canal retreatment practices and ultimately advancing the field of endodontics.

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