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Comparative Evaluation of Time Taken to Retrieve Gp Using Two Different Retreatment Files In Root Canal Treated Teeth- An In Vitro Study

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ABSTRACT

Introduction: The use of non-surgical retreatment is a conservative approach compared to periapical surgery for treating persistent infections. To ensure effective treatment, the retreatment procedure should be performed efficiently using suitable instruments. The purpose of this study is to compare the time required for two different rotary instruments to remove endodontic material from the root canal and evaluate the amount of remaining filling material on the root canal wall.

Materials and Methods: This research study aimed to compare the effectiveness of two distinct file systems for retreatment - Protaper Universal and Solite RS3 - in removing gutta-percha from root canals. The study involved the use of 60 single-rooted teeth that underwent cleaning and shaping using the Step Back technique with a master apical file size of 40. The canals were irrigated with 3% NaOCl and 17% EDTA to eliminate the smear layer, followed by drying with paper points. Lateral compaction technique was employed for obturation with AH Plus sealer. The teeth were divided into two groups, and a stop clock was used to record the time taken to remove the gutta-percha. The remaining gutta-percha on the root canal wall was evaluated using CBCT, and statistical significance was determined using the independent t-test.

Results: Based on the results, it can be inferred that the Hyflex Remover file system took longer to retrieve the gp in comparison to the Solite RS3 files.However, the difference between the two files is not considered significant based on the statistical analysis ($p<0.05$).

Conclusion: The study was limited by a small sample size, use of single rooted teeth, and an in vitro setting. However, based on the study's constraints, it can be inferred that Solite RS3 files were quicker than Protaper Universal files in removing gutta-percha from root canals. None of the systems used were able to entirely eliminate filling materials, indicating a need for additional procedures and techniques to enhance root canal cleanliness.

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Keywords: *Guttapercha, Protaper Retreatment files, Retreatment,Retrieval , Root canal, Solite RS3, Medical, Conservation*

INTRODUCTION

The success rate of root canal treatment depends on creating a fluid-tight seal throughout the root canal system in three dimensions. This treatment is successful in about 86-98% of cases, but certain factors may require retreatment, such as an improper apical seal, remaining pulpal tissue, incomplete cleaning, missed canals, or an inadequate filling.(1) It is generally preferred to retreat the canal nonsurgically rather than surgically. However, root canal retreatment can be challenging for clinicians, particularly in curved canals where the filling material may be resistant and difficult to remove.(2,3) Proper removal of the filling material is essential to eliminate any remaining bacteria that can cause post-treatment disease. If the filling material is not fully removed, it can prevent irrigants and intracanal medicaments from effectively flowing into the canal, which can hinder the healing process. Therefore, complete removal of the obturating material is crucial for the success of root canal retreatment.(4,5)(6)

An essential factor in root canal retreatment is to completely remove all endodontic material from the root canal system to achieve the goals of endodontic treatment.(7,8) Clearing the root canal wall of the endodontic material is crucial for effective disinfection and retreatment. (9)Therefore, it is essential to remove the endodontic material completely from the root canal wall. To achieve this, several devices have been used to retrieve the obturating material.(7) Compared to conventional files, rotary NiTi files are more effective at removing the material and creating a tapered preparation, making the process less laborious.(10,11)(12)

There are several methods to remove the obturation material, including mechanical removal using hand and rotary instruments, chemical removal using GP solvents, and physical removal using heat and ultrasonic instruments.(2) The time required to remove the GP can be influenced by the use of thermal, mechanical, chemical, or a combination of these methods.(5) (13)Previous research suggests that rotary instruments are faster at removing the GP compared to hand instruments due to their higher speed.(14) Numerous studies have investigated the effectiveness of rotary instruments in GP removal but no studies have compared their efficacy with the Hyflex REmover file system.(15)

The objective of the current study is to evaluate the efficacy of a new type of file for root canal retreatment, called Solite RS3 retreatment files and compare its effectiveness with the Hyflex Remover file system. Hyflex Remover (Switzerland) file is a single retreatment files system which has a taper of 7% and an apical diameter size of 30. It has a Minimally invasive 1mm wire and is said to be efficient without any solvent. It has non-cutting tips and are available at two lengths 15.5mm and 18.5mm having an active blade for 15.5mm and 18.5mm respectively. Solite RS3 (India) files are different from the Hyflex Remover files in that they are heat treated. It comprises of active cutting edges from 10mm- 18mm, tapers of the file ranges from 6%-8%, the tip diameters in the range 0.20-0.30mm. The purpose of active edges in the file is that it disengages the Gutta Percha (GP) from the canal and preserves the remaining dentin, each 1mm the taper varies based on each file. In addition to their unique design, Solite RS3 retreatment files are available in three different lengths, tapers, and colours to simplify identification.(16) These files are also flexible enough to adapt to the curves of the canal while removing gutta-percha without accidentally damaging the root canal dentin.(17)

The primary objective of this study is to compare the time required to remove gutta-percha using the Hyflex Remover file system and Solite RS3 files. The study also aims to evaluate the quantity of remaining gutta-percha on the root canal wall after the retreatment procedure.

MATERIALS AND METHODS

Specimen preparation

The study involved selecting 60 teeth that had recently been removed and had only one root

with a fully developed apex. The research was approved by the Institutional Ethical Committee under the reference number SRB/SDC/ENDO-2067/19/012. To qualify for inclusion in the study, the teeth had to meet certain conditions, including having a single canal, showing no evidence of cracks or fractures, and displaying no signs of external or internal resorption. Additionally, curvature of the canal had to be less than 15 degrees. The teeth were checked using digital radiography in both a mesiodistal and buccolingual direction to confirm the presence of a single straight canal. They were then treated with a diamond disk to remove the crown, and their length was standardised to 18 mm.

Root canal preparation

After selecting the teeth, they were separated into two groups for the study. A cavity was created in the teeth to allow for endodontic access, and a #10 k-file was used to establish a glidepath. The cleaning and shaping of the canals were carried out using the Step Back technique, where the master apical file size 40 was used. To remove the smear layer, a combination of 3% NaOCl and 17% EDTA was used for irrigation. The root canals were then dried using paper points. The canals were filled with gutta-percha using the lateral compaction technique along with the AH Plus sealer. After completing the obturation, composite resin was used to seal the teeth, and they were kept in a humid environment.

Gutta percha retrieval

A week after the obturation process, the teeth underwent retreatment using Coltene Hyflex Remover and Solite RS3 retreatment files as assigned to their respective groups. Chemical solvents were not used during the retreatment process. The root canals were periodically irrigated with 3% NaOCl while the gutta-percha was being removed, and the final rinse was done with saline solution. To evaluate the effectiveness of the retreatment preparation, digital radiographs were taken to check for any traces of the obturating material or sealer left in the canals. The time taken for the gutta-percha removal process was recorded using a stopwatch, and the amount of remaining gutta-percha was assessed using conventional radiographs.

Statistical analysis

The study documented the time taken by each group to retrieve the endodontic material and recorded the data in an excel sheet. The collected data were analysed statistically using the SPSS version 23.0 software. An independent t-test was performed to evaluate the significance, where a p-value of less than 0.05 was considered to be statistically significant.

RESULTS

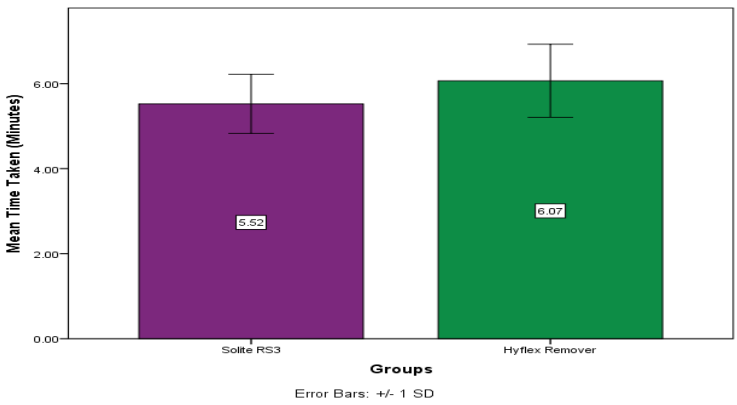

FIGURE 1: The bar graph depicts the mean time taken for the removal of gp using Solite RS3 file and Coltene Hyflex Remover File.

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TABLE 1: Table shows the mean and standard deviation for the time taken for Gutta Percha Retrieval using the two file systems Solite RS3 and Hyflex Remover. $p<0.05$(statistically significant)

Groups	N	Mean ± Std.Dev	P value
Solite RS3	30	5.52 ± 0.69	0.287
Hyflex Remover	30	6.07 ± 0.85	

DISCUSSION

The success of a retreatment in endodontics is reliant on the clinician's ability to eliminate as much filling material as possible. This facilitates access to areas containing necrotic tissue or bacteria that may cause endodontic failure.(3) However, in this particular study, complete removal of root canal filling was not achievable, which is consistent with previous studies. Difficulty in completely removing the filling material was particularly noted in the apical and middle thirds of the canal. This can be attributed to anatomic variability in the apical third of mandibular mesial roots, which could explain why these areas were hard to clean.(18)

There are several factors that can contribute to endodontic failure, including incomplete cleaning of the root canal, incomplete obturation, and missed canals. This may result in pain or other post operative complications,which may require retreatment.(19) Non-surgical retreatment is typically preferred over surgical intervention, as it is a less invasive option. In fact, endodontic retreatment is largely replacing endodontic surgery as the preferred approach for resolving persistent periapical infections.(20)

Numerous studies have been conducted in the past to compare the efficacy of various file systems in removing obturating material. (21,22)These studies followed specific protocols, such as the use of chemical solvents to remove gutta-percha, and two-dimensional digital radiography to confirm the complete elimination of the filling material.(11,23)

The study did not utilise solvents because their use might result in incorrect outcomes, as previous research has shown that solvents can leave large amounts of endodontic material and sealer on root canal walls during retreatment procedures.(24),(25,26) Additionally, the use of solvents may further irritate periapical tissues, making it difficult to determine the amount of time required for retrieval accurately, as reported by previous studies.(27)

Various methods, such as conventional radiographs,microcomputed CT,CBCT and longitudinal sectioning, are recommended for evaluating the remaining obturating material in endodontic retreatment.(28,29) However, in this particular study, conventional radiographs were used to assess the complete removal of filling material.(30) The time taken to retrieve the gutta-percha was measured using a stopwatch.(28) Rotary instruments are typically preferred over hand instruments for retreatment procedures, as they soften the gutta-percha due to friction, making it easier to remove. Additionally, rotary instruments can reduce operator fatigue, working time, and help to maintain the shape of the canal.(31)

The study found that a higher amount of gutta-percha remained in the apical third compared to the coronal and middle thirds of all specimens. This may be attributed to the use of a master apical file with a size of 40 k, a tip size of 0.40, and a taper of 6% during cleaning and shaping.(32),(33)For retreatment, rotary files with larger tip sizes, such as Endostar RE endo with a tip size of 0.30 and a taper of 7% and Mani GPR file with a tip size of 0.30 and a taper of 6-8%, were used as the master apical files.(34) This may have resulted in some gutta-percha remaining in the apical third of the root canal, as observed in the study. Furthermore, the shape of each canal is unique, and regardless of the preparation techniques used, there will be untouched surface areas in the root canal, which may have also contributed to the residual gutta-percha. Therefore, after retreatment with rotary NiTi files, additional circumferential filing should be performed using an H file.(35,36)

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In the current study, the less effective removal of gutta-percha in all thirds of the canals by manual instrumentation may be due to the fact that NiTi rotary instrumentation heats and softens the gutta-percha, making it less resistant and easier to remove. The Solite RS3 file system showed good results in gutta-percha removal, possibly because files have a convex triangle cross-section with 3 point contact cutting edges to disengage the Gutta percha and good elasticity. They also have great cutting ability, a non-cutting tip, and good elasticity. In contrast, the Hyflex Remover file has only one cutting edge.

The current study used two different types of files for root canal retreatment: Hyflex Remover and SoliteRS3. SoliteRS3 files come in three different sizes and colours to facilitate identification and have heat-treated RS2 and RS3 files that are designed to flex through canal systems. The study found that Hyflex Remover files took longer to remove filling material compared to Protaper Universal files, but the difference was not significant. This may be due to the flexibility of the files and their heat treatment, which did not result in faster removal of the filling material.

CONCLUSION

The study was limited by a small sample size, use of single rooted teeth, and an in vitro setting. However, based on the study's constraints, it can be inferred that Solite RS3 files were quicker than Protaper Universal files in removing gutta-percha from root canals. None of the systems used were able to entirely eliminate filling materials, indicating a need for additional procedures and techniques to enhance root canal cleanliness.

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