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COMPARATIVE ANALYSIS TO DETERMINE THE EFFECTIVENESS OF THREE DIFFERENT RETREATMENT ROTARY FILE SYSTEMS TO REMOVE GUTTA PERCHA FROM THE ROOT CANAL

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ABSTRACT

The study's objective is to evaluate the effectiveness of three distinct retreatment rotary file systems for removing gutta-percha from the root canal. Thirty extracted human single-rooted teeth were used in this investigation. Protaper Gold was used to instrument the samples. Canals were obturated with gutta percha using seal apex sealer. Based on the retreatment rotary file systems used to remove the filling material, the samples were then randomly divided into three groups: Group 1 consisted of Neoendo retreatment files (Orikam, India); Group 2 was the Protaper Universal Retreatment system (Dentsply Malliefer in Ballaigues, Switzerland); Group 3 consisted of the EdgeFile XR NiTi system (EdgeEndo in Albuquerque, NM, USA). After utilizing the corresponding retreatment systems, samples were examined using CBCT to determine how much filling material was still present in the root canal. While no sample demonstrated total gutta-percha removal, the Protaper Universal Retreatment system outperformed the EdgeFile XR NiTi system and Neoendo retreatment files in terms of evaluation results. Compared to the EdgeFile XR NiTi system and the Neoendo retreatment files, there were less infill materials left in the canals treated with the Protaper Universal Retreatment system. EdgeFile XR can be used as an alternative to ProTaper Universal Retreatment files, while the Protaper Universal Retreatment method is superior but more inflexible.

KEYWORDS: CBCT, Edge File XR NiTi System, Neoendo Retreatment, Protaper Retreatment

Bacteria may persist in the root canal system as a result of improper cleaning, untreated canals, poor filling, or coronal/apical leaking, which can lead to post-treatment endodontic illness (Siqueira, 2001). Nevertheless, the foundation of success is failure. Consequently, the obturating material (gutta percha and root canal sealer) needs to be extracted from the root canal system as much as possible in order to minimize the amount of bacteria (Siotia *et al.*, 2011). In order to achieve three-dimensional root canal system cleansing, contouring, and obturation by nonsurgical methods, all filling materials must be removed entirely from the endodontic area (Stabholz and Friedman, 1988). Either hand instruments or rotating instruments can be used to accomplish this. Stainless steel hand files (Imura *et al.*, 2000; Schirrmeister *et al.*, 2006), Gates Glidden drills, nickel-titanium (NiTi) rotary instruments, ultrasonic instruments (Schirrmeister *et al.*, 2006; Dadresanfar *et al.*, 2012; Khalilak *et al.*, 2013; Akhavan *et al.*, 2012), heat-bearing instruments (Friedman and Mor, 2004), lasers (Viducic *et al.*, 2003), and the use of adjunctive solvents are some of the methods that can be used to remove the root filling material from the root canal system. Chair-side clinical time has been reduced by retreatment procedures that remove gutta-percha with rotating devices (Schirrmeister *et al.*, 2006). The purpose of neoendo retreatment files is to clean out filler from canals. There are three files in the pack: N1, N2, and N3. The N1 and N2 sizes are 16 and 18 mm, whereas the N3 sizes are 22 and 25 mm. The N1 instrument is intended for usage in the coronal one-third. Its dimensions are 16 mm in length, 0.30 mm at the tip, and 9% taper. The N2 features an 8% taper, an 18 mm length, and a 0.25 mm tip. It is intended for use in the central third. The N3 is designed to be utilized at the apical one-third and has a length of 22 mm, a tip diameter of 0.20 mm, and a 7% taper. The purpose of the ProTaper Universal System retreatment files (PTUS) is to make filler material removal easier. Three retreatment files are included in all. The apical tip sizes, taper, and lengths of each file vary. The D1 PTUS instrument is 16 mm long, has a 0.30 mm tip, and taper of 9%. Its active tip helps with early penetration into the filling substance. The D2 PTUS instrument features an 8% taper, an 18 mm length, and a 0.25 mm tip for removing filling material at the middle third of the root. To attain the working length, the D3 PTUS tool for apical filling removal is utilized. It has a length of 22 mm, a tip of 0.20 mm, and a 7% taper. The market has seen the introduction of EdgeFile XR retreatment nickel-titanium (Ni–Ti) rotary files, which are composed of an annealed heat-treated Ni–Ti alloy known as Fire-Wire™. Heat treatment can alter the strength and

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deformation properties of metals and metal alloys. The manufacturer claims that Fire-Wire™ Ni-Ti delivers exceptional flexibility and performance-enhancing durability, enabling XR files to accelerate and improve endodontic retreatment. Four files are included in the system, which are used in a crown-down fashion: R1 (25/0.12), R2 (25/0.08), R3 (25/0.06), and R4 (25/0.04). Every file has a parabolic cross section and a consistent taper.

MATERIALS AND METHODS

For this investigation, thirty human teeth with single roots were employed. They lacked caries, fractures, anatomical deviations, and immature apex. The teeth were kept in formalin for a week before being placed in regular saline for usage. Curettes were then used to remove the soft tissue that covered the root surface. The access was opened. The working length was ascertained by inserting a 15-number stainless steel K file into the root canal until the instrument's tip was visible at the end. Protaper gold files (Dentsply Malliefer, Ballaigues, Switzerland) were used to form the root canals. The root canals were irrigated with a solution of 17% ethylenediaminetetraacetic acid (EDTA) and 5.25% sodium hypochlorite (NaOCl) during the shaping phase. After that, paper points were used to dry the root canals. After that, sealapex sealer was used to obturate the samples. After that, they were temperature-controlled and kept for a week at 37°C with 100% humidity to enable the sealer to fully seal. Next, based on the retreatment rotary file systems used to remove the filling material, the samples were randomly split into three groups: Group 1 consisted of Neoendo retreatment files from Orikam, India; Group 2 was the Protaper Universal Retreatment system from Dentsply Malliefer in Ballaigues, Switzerland; Group 3 consisted of the EdgeFile XR NiTi system from EdgeEndo in Albuquerque, New Mexico, USA. As directed by the manufacturer, group I's Neoendo files (Orikam, India) were employed, starting with the first file's 30/9% coronal third, moving on to the middle third's 25/8%, and the apical third's 20/7%, until the files were free of filler material. As directed by the manufacturer, group 2 employed the ProTaper Universal retreatment files (Dentsply Maillefer Ballaigues, Switzerland). Until the files were free of filler material, the coronal third was measured with an instrument D1 (30/9%), the middle with an instrument D2 (25/8%), and the apical third with an instrument D3 (20/7%). The R1 (25/0.12), R2 (25/0.08), R3 (25/0.06), and R4 (25/0.04) files were employed in a crown-down fashion with light to medium pressure in an apical manner for group 3, Group EdgeFile; (EdgeEndo, Albuquerque, NM, USA). Until R4 reaches WL, the sequence was repeated. Next, utilizing EdgeFile X3-C4 file (size 40/0.06 taper) at 500 rpm and 3 Ncm torque as EdgeFile XR retreatment rotary files, the last apical preparation was carried out. Using CBCT equipment, samples were scanned following the removal of root canal filling material in each group and the amount of remaining filling material was analyzed. The collected data were subjected to post hoc multiple comparison analysis and one-way analysis of variance (ANOVA) with a significance level of P = 0.05.

RESULTS

The following was the mean ± standard deviation, respectively: Neoendo retreatment files (15.51±1.24), EdgeFile (11.60±2.13), and Protaper Universal Retreatment system (11.03±1.34). When Neoendo retreatment files were utilized instead of ProTaper Universal retreatment files and EdgeFile files for infill material removal, a statistically significant change was seen. The EdgeFile Remover file (EdgeEndo, Albuquerque, NM, USA) and the ProTaper Universal retreatment files (Dentsply Maillefer Ballaigues, Switzerland) did not significantly vary statistically, though. (Table 1)

Table 1: Comparison of remaining gutta‑percha material expressed as mean±standard deviation

Group	N	Mean±SD	P
Neoendo retreatment files	10	15.51±1.24	<0.05**
Protaper Universal Retreatment System	10	11.03±1.34	>0.05*
EdgeFile XR	10	11.60±2.13	>0.05*

DISCUSSION

Retreatment is a process that involves cleaning and reshaping the root canal system in addition to removing filling material from the pulp cavity, according to the American Association of Endodontists Glossary of Contemporary Terminology for Endodontics (AAE, 2003). Endodontic failure may result from microorganisms that continue to exist or recolonize in the root canal system following obturation due to coronal or apical leakage (Mollo *et al.,* 2012). Therefore, root canal retreatment is frequently necessary when the first endodontic care is ineffective. In order for nonsurgical root canal retreatment to be successful, all diseased filling materials, including gutta-percha and sealers, must be completely removed from root canals in order to facilitate proper root canal cleaning, shape, and refilling (Friedman *et al.,* 1990). Protaper gold files were the same file system that was used to prepare single-rooted teeth in order to simplify the standardization of the specimens. Sealapex sealer was used to obturate the samples following the shaping process. The literature describes a number of techniques for clearing the root canal filling material from the canals. This includes modern nickel-titanium (NiTi) rotary files from Endotec devices, traditional hand files, Gates Glidden drills, ultrasonics, heat, laser, GPX drills, and GG drills (Fenoul *et al.,* 2010). When root canal content is removed solely mechanically, it may result in iatrogenic problems such canal straightening, ledge, perforation, or anatomical changes to the canal. It takes a lot of effort and time to remove filled content from canal using traditional H files. By reducing operator and patient fatigue, rotary NiTi instrumentation can facilitate a more efficient and quicker completion of the procedure (Fenoul *et al.,* 2010). This study's objective was to assess how well Neoendo, ProTaper Universal retreatment, and EdgeFile XR Remover files removed filler material from root canals. The samples were scanned using CBCT after the root canal filling material was removed in accordance with the manufacturer's instructions. A non-invasive technique called CBCT was employed to visualize morphological characteristics in great detail (Bergmans *et al.,* 2001). This process is easy to use, effective, and sensitive enough to locate tiny patches of leftover filler material on the canal walls. The teeth do not have to be destroyed in order to evaluate the root canal system in three dimensions thanks to CBCT scanning. The CBCT study discovered notable variations in the filler material removal process across Neoendo retreatment files, the Protaper Universal Retreatment system, and the EdgeFile XR Remover file. The Protaper Universal Retreatment method and EdgeFile XR Remover file did not, however, differ much. In comparison to Neoendo retreatment files, the Protaper Universal Retreatment system and EdgeFile XR Remover file reduced the average volume of residual filling materials in the canals. This indicates that filler materials were removed more effectively using the Protaper Universal Retreatment system and the EdgeFile XR Remover file than using the Neoendo retreatment files. The length design of the D1, D2, and D3 files, along with the three progressive tapers, are responsible for the superior concert of the Protaper Universal Retreatment system instruments (Gu *et al.,* 2008).

CONCLUSION

Within the constraints of this investigation, it may be inferred that EdgeFile XR can be utilized as a ProTaper Universal Retreatment file substitute, and that the Protaper Universal Retreatment method is superior but more inflexible.

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