

**CBCT Evaluation of Obturating Material Removal Using Reciproc And Protaper D Retreatment Kit in Root Canal and Efficacy In Removing The Obturating Material - In Vitro Study**

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**Abstract**

**Aim:** The Aim of the study is to evaluate the removal of obturating material removal using Protaper D, Reciproc Retreatment kit in root canal and Efficacy in removing the obturating material using CBCT.

**Material & Method:** Thirty extracted human single-rooted, verified radiographically teeth were selected and stored in a 0.1% thymol. Access cavity preparation was done and working length was determined by inserting a size 10 K file (Dentsply/Maillefer) into the root canal until it was visible at the apical foramen and subtracting 1mm from that length. Root canal preparation was done using ProTaper universal rotary files. All canals was prepared upto F4 ProTaper file. Irrigation was done after each instrument with 10mL of 2.5% NaOCl. Canals were then dried with paper point. The root canals were obturated

with corresponding ProTaper gutta-percha cones with AH plus root canal sealer. The gutta percha was then removed using Reciproc retreatment files and Protaper D Retreatment files.

**Result:** There was significant difference in residual OM in the apical, middle and coronal areas between the two retreatment techniques ( $P<0.05$ ).

**Conclusion:** Reciproc Blue retreatment instruments were more effective in the removal of filling material from the root canal than Protaper D Retreatment file. However the difference was not significant. Reciproc Blue provided cleaner canals in the apical region when compared to Protaper D.

**Keywords:** CBCT, Protaper D Retreatment file, Reciproc Retreatment Kit

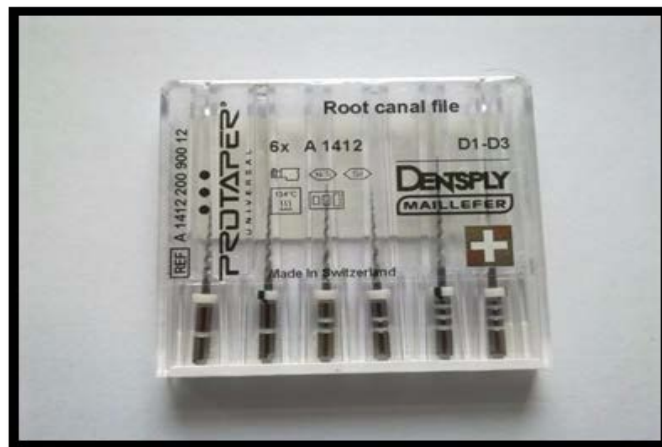
## Introduction

Post-treatment endodontic disease might occur due to persistence of bacteria in the root canal system as a consequence of insufficient cleaning, untreated canals, inadequate filling or new infection due to coronal/apical leakage. Non-surgical root canal retreatment is the first choice to re-establish the healthy periapical tissues. The procedure requires complete removal of the filling material from the canal system to allow effective cleaning, shaping and re-filling. Core filling material and the sealer must be removed from the canal as the first step in retreatment of previously filled canals. An ideal root filling should be easily removed.

Some researchers reported that the GuttaFlow root filling (Coltene/Whaledent, Langenau, Germany) was removed more easily from the canal in comparison with gutta-percha and AH 26 sealer.<sup>1</sup>

In many studies it is stated that the use of nickel-titanium (NiTi) rotary instruments is a safe and efficient way of removing root canal obturating material during endodontic retreatment. Rotary instruments require less time to clean the canals compared to hand instruments; therefore, both the patient and operator would benefit from less chair time. The safety and cleaning efficacy of rotary instruments is also proved.<sup>2</sup>

**Pro Taper Universal retreatment kit** (Dentsply Maillefer, Ballaigues, Switzerland) include **D1** (30/0.09), **D2** (25/0.08) and **D3** (20/0.07) files with different tapers and tip diameters which are specifically designed to remove the root canal OM from the coronal, middle and apical thirds of the canals, respectively. Similar to finishing and shaping ProTaper instruments, retreatment files have a convex cross-section.<sup>3</sup>



**Figure 1: Protaper-D Retreatment Kit**

A new reciprocating motion approach was introduced for instrumentation using nickel-titanium instruments with M-Wire alloy which increases the resistance and flexibility of the reciprocating instruments than the conventional alloy. **Reciproc** (VDW, Munich, Germany) is based on this motion. Reciproc has an Sshape cross-section.<sup>4</sup>

**RECIPROC** instruments are marked with the ISO colour of the instrument tip size for easy identification. **R25** prepares the root canal to a diameter of 0.25 mm with a taper of .08 over the first apical millimetres. **R40** prepares the root canal to a diameter of 0.40 mm with a taper of .06 over the first apical millimetres. **R50** prepares the root canal to a diameter of 0.50 mm with a taper of .05 over the first apical millimetres.<sup>5</sup>



**Figure 2: Reciproc Blue File**

The manufacturers claim that the reciprocal motion would reduce the torsional stress by periodically reversing the rotation (150° counter clock wise, then 30° clockwise rotation).<sup>6</sup>

Use of **Cone-Beam Computed Tomography (CBCT)** in endodontics has been common in recent years and it has exhibited better efficacy compared to routine radiographic techniques in the diagnosis of apical periodontitis, evaluation of the root canal system, resorptive lesions and in treatment planning of endodontic surgery.<sup>7</sup>

The aim of the study is to evaluate the removal of obturating material using Protaper D, Reciproc Retreatment kit in root canal and Efficacy in removing the obturating material using CBCT.

### **Methodology**

Thirty extracted human single-rooted, verified Radiographically teeth were selected and stored in a 0.1% Thymol. Access cavity preparation was done and working length was determined by inserting a size 10 K file (Dentsply/Maillefer) into the root canal until it was visible at the apical foramen and subtracting 1mm from that length. In order to standardize all the teeth, the teeth were decoronated to reach a root length of 20 mm and a WL of 19 mm was chosen for all the teeth. Root canal preparation was done using Pro Taper universal rotary files (Dentsply Maillefer, Switzerland) as per manufacturer's instructions. All canals was prepared upto F4 Pro Taper file. Irrigation was done after each instrument with 10mL of 2.5% NaOCl (Avorice, India). Canals were then dried with paper point. The root canals were obturated with corresponding ProTaper gutta-percha cones (Dentsply/Maillefer) with AH plus (Dentsply De Trey, Konstanz, Germany) root canal sealer. Prior to use, the sealer was mixed until it reaches a thick consistency, in accordance with the manufacturer's instructions.

At this stage, all the primary CBCT images were taken. The access cavity was temporarily sealed. Then the samples were stored at 37 C and 100% relative humidity for 14 days for the complete setting of the sealer. Then the samples were randomly allocated into groups 1 and 2 (n=15) according to the retreatment technique. **Group 1: Reciproc Retreatment Kit, Group 2 : Protaper D.**

### **Group 1: (Reciproc)**

The root canals were re-instrumented using the Reciproc R50 instrument (VDW, Munich, Germany) i.e. single use instrument. The instrument was activated by a VDW Silver electric motor and applied in a reciprocating motion. It was then moved towards the apex using an in-and-out pecking motion with amplitude of approximately 3 mm. Gentle apical pressure was combined with a brushing action against the lateral walls, according to the manufacturer's instructions until the canal walls became smooth, and there were no evidence of filling material on the instrument which was verified radiographically. A total volume of 25 mL of 2.5% NaOCl was used for irrigation followed by irrigation with 5 mL of a 17% EDTA aqueous solution. Final irrigation was performed with 5 mL of a 2.5% NaOCl solution. After irrigation, the canals were dried with paper points.

### **Group 2: (ProTaper retreatment kit)**

ProTaper files were used at a speed of 300 rpm with a 3 N/m torque. The coronal third of the canal was cleaned with Pro Taper D1 file (30/0.09). The obturating material in the middle and apical thirds was removed with D2 (25/0.08) and D3 (20/0.07) files, respectively. Preparation of the apical area was carried out with F2 (25/0.08) and F3 (30/0.09) instruments. The final rinse was carried out by 5 mL of 20% EDTA and 5 mL of 1% NaOCl. Then the root canals were dried with paper points.

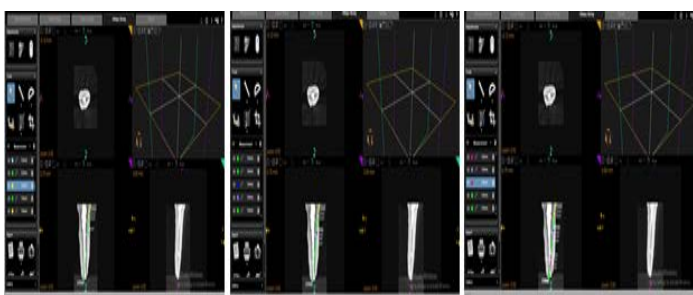


Figure 3 (a), (b), (c): Showing the Pre-CBCT measurements of gutta percha in the coronal, middle, apical portion using RECIPROC respectively

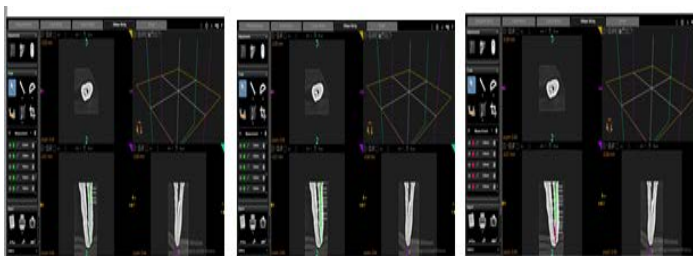


Figure 4 (a), (b), (c): Showing the Post-CBCT measurements of remaining gutta percha in the coronal, middle, apical portion using RECIPROC respectively

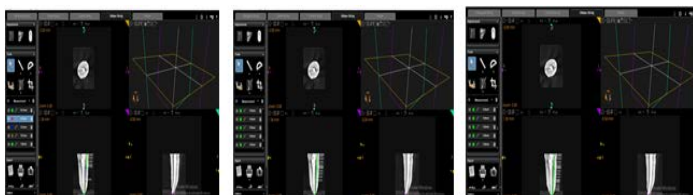


Figure 5 (a), (b), (c): showing the Pre-CBCT measurements of gutta percha in the coronal, middle, apical portion using PROTAPER D respectively

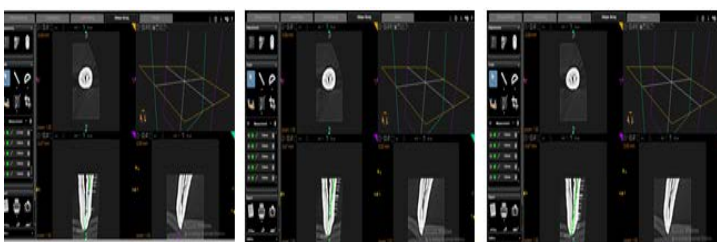


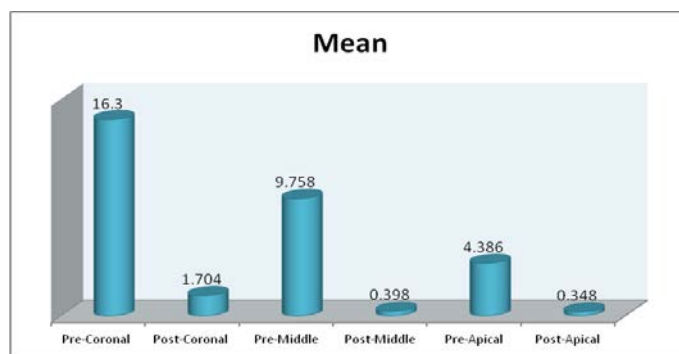
Figure 6 (a), (b), (c) : showing the Post-CBCT measurements of remaining gutta percha in the

coronal, middle, apical portion using PROTAPER D respectively

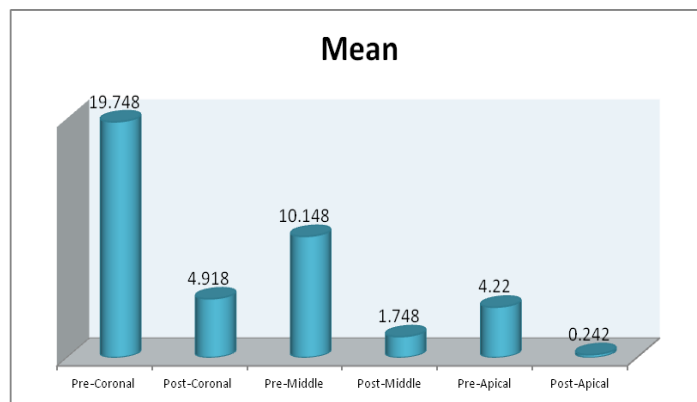
### Results

The study was carried out on 30 extracted mandibular premolars. The ANOVA analysis revealed significant differences between the groups removal of obturating material.

There was significant difference in residual OM in the apical, middle and coronal areas between the three retreatment techniques ( $P < 0.05$ ). In the Protaper D group, the residual OM in the apical area was significantly more than that in the middle and coronal thirds. In the Reciproc blue group there was significant removal of residual obturating material from coronal, middle as well as apical third of the root canal.



Graph No 1: Descriptive statistics of remaining obturating material in the apical, middle and coronal thirds of Group I (RECIPROC Blue)



Graph 2: Descriptive statistics of remaining

## obturator material in the apical, middle and coronal thirds of Group II (Protaper D)

### Discussion

In the present study, straight root canal configuration were taken in all the three study groups. In order to standardize, the samples were decoronated. Also the root canals were shaped in a similar manner in all the samples by the same operator. The root canals were obturated with gutta-percha and sealer using lateral compaction technique.<sup>8</sup> AH-Plus sealer was used in the present study, which can bind to canal dentin. NiTi rotary retreatment system that has been proposed for retreatment because of their safety, efficiency and speed in removing gutta-percha and the sealer were selected for the study.<sup>9</sup>

The aim of this study was to evaluate the efficacy of different reciprocating and continuous rotary NiTi instruments during root canal retreatment. It has already been reported that rotary files require less time during retreatment compared to hand files and Bramante *et al*<sup>10</sup>, attributed this shorter time to the plasticity of gutta-percha with the use of rotary instruments and therefore, the softer removal of the obturating material.<sup>11</sup>

The results of the present study showed that retreatment with RECIPROC BLUE showed higher percentage of removal of obturating material than Protaper D especially in the apical section. This might be attributed to a higher efficacy of RECIPROC BLUE in removing gutta-percha in one bulk after its enlargement in the file flutes. RECIPROC BLUE was found to have less remnant filling material than Protaper D in apical section in this study.

This may be understood as the result of interplay between two main factors:

1. The asymmetrical reciprocation kinematics which means cutting the dentin in counter clock wise (ccw) direction being immediately released in clockwise motion.

As the clockwise angle is smaller than the counter clockwise angle, the instrument tends to advance towards the apex, this can be the reason why the files has cleaner canals in the apical area

2. The S shaped cross section of the shape of the instruments which provides an effective cutting ability to the instrument blades.<sup>12</sup>

These factors together with the marked taper of these files, creates a greater contact area between the instruments and gutta-percha allowing filling removal that is as effective as that produced with continuous rotation.<sup>12</sup>

Protaper D- effectiveness is due to the convex triangular cross section which renders a large internal area. D1, D2, and D3 have three progressive tapers and lengths. These features enable the retreatment instruments to cut not only gutta-percha but also the superficial layer of dentin during root filling removal.<sup>13</sup>

Moreover, the specific flute design and rotary motion of these files tend to pull gutta-percha into the file flutes and direct it towards the orifice. Which is in accordance with a study by Betti and Bramante 2001<sup>6</sup>.

The reason for the Protaper D to be less efficient though not significant than RECIPROC might be because of lack of radial guide, which exert cutting action instead of a smoothing action on gutta percha.<sup>13</sup>

### Conclusion

Under the conditions of the present study, it was impossible to completely remove the root canal filling material regardless of the technique used. Reciproc Blue retreatment instruments were more effective in the removal of filling material from the root canal followed by Protaper D. However the difference was non significant. Reciproc Blue provided cleaner canals in the apical region when compared to the Protaper D Retreatment experimental groups.



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