IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 4 Ver. VIII (Apr. 2015), PP 116-120
www.iosrjournals.org

Efficacy Of Various Instrumentation Techniques For Removing Filling Material During Root Canal Retreatment Using Cone Bean Computed Tomography –An In-Vitro Study

Ruchi Gupta[1], Anil Dhingra[2], Neetika[3]
[1,2,3.] *Department of conservative Dentistry and Endodontics , D.J. College of dental sciences & research, India*

Abstract:
Aim*: To compare the efficacy of various instrumentation techniques for removing obturating material from root canals using Cone Bean Computed Tomography (CBCT).*
Materials and Methods: *Thirty extracted human premolar teeth, each with a single canal were selected. The root canals were prepared upto F4 ProTaper file and obturated with corresponding gutta percha cone. Teeth were divided into three groups according to the technique used for removing the obturating material: group I – Reciproc R50 instrument; group II – Gates–Glidden burs and hand files up to size 50; group III – Mtwo files upto size 50, 0.04 taper. The amount of remaining filling materials after the retreatment procedures was assessed by CBCT. The data was statistically analysed by One way Anova test.*
Results*: Group I (reciprocating technique with the Reciproc R50 instrument) left less remaining material compared with group II (hand files) and group III (rotary technique with Mtwo R instruments)*
Conclusion: *The reciproc file was most effective in removing the gutta-percha from the root canal.*
Keywords: *Cone Bean Computed Tomography, Retreatment, Recipro, M Two, Rotary file*

I. Introduction

Endodontic failure occurs even when the highest standard and the most meticulous treatment procedure is adhered. When conventional root canal treatment fails, endodontic retreatment is the preferred option as it is one of the most conservative methods. Obturating material in failed endodontic cases and necrotic tissue & bacteria, covered by obturating material, may be responsible for periapical inflammation. As much as possible, the obturating material must be removed to reduce the number of microorganisms within the canal.

During endodontic therapy, gutta-percha is the most widely used core material for obturation in conjunction with different sealers [1]. Various techniques are used for removal of GP such as hand instruments with or without chemical solvents, heat, rotary instruments and ultrasonic devices [2]. In recent years, nickel titanium files have been used increasingly in root canal preparation due to their increased flexibility.

Single-file technique for root canal instrumentation has been proposed because of their convenience and alleged simplification. One of these single-file instrumentation systems is the Reciproc instrument (VDW, Munich, Germany). This instrument is made of standard NiTi alloy with M-wire treatment and is recommended for a single case. Mtwo (VDW, Munich, Germany), an endodontic rotary file system incorporates a variable pitch and steep helical angle and comes in various fixed tapers. Its S-shaped cross section with no radial lands and minimal core width renders it with an optimal cutting and shaping efficiency [3]. There have been no studies published till date on the use of cone-beam computed tomography (CBCT) to assess and compare the removal of obturating material from root canals by Mtwo files with that of Reciproc and handfiles. Even no study has yet checked the remaining guttapercha in coronal, middle and apical section of a root canal till date using Reciproc and M File.The present study was done to evaluate and compare the efficacy of these new rotary techniques for removing obturating material during root canal retreatment using cone beam computed tomography.

II. Material And Methods

Thirty extracted human single-rooted straight premolars, verified radiographically 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 (Dentsply Maillefer, Switzerland) as per manufacturer's instructions. All canals were prepared upto F4 ProTaper file. Irrigation was done after each instrument with 10mL of 2.5% NaOCl (Avorice, India). When instrumentation of the root canals was completed, 17% ethylenediaminetetraaceticacid (India) was used for 1 minute for smear layer removal, and the canals were again irrigated with 5mL of 2.5% NaOCl. 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 reached a thick consistency, in accordance with the manufacturer's instructions. The canal access was restored with Cavit-G (3M Espe, Germany), and the teeth were stored under 100% humidity at 37 °C. Teeth were radiographed in buccolingual and mesiodistal direction to confirm the adequacy of root fillings Fig 1.
Teeth were randomly divided into three experimental groups.

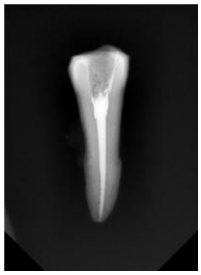


Figure 1: Buccolingual Radiograph of a sample after Obturation

Group 1

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 an 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 was 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. To eliminate inter operator variability, the same operator carried out all intracanal procedures. Assessment of effective gutta-percha removal was done by calculating the obturating material remnants in each tooth at coronal, middle and apical third of the root canal.

Group 2

Gates–Glidden burs sizes 2 and 3 were used in the middle third of the canals at a depth of 6 mm. The working length was reached with a size 50 file followed by file sizes 55, 60, 70 and 80 in a step-back motion. Each set of instruments was used for the preparation of three root canals and then discarded.

Group 3

Mtwo rotary retreatment file sizes 15, 0.05 taper and 25, 0.05 taper (VDW, Munich, Germany) and Mtwo rotary file sizes 30,0.05 taper; 35, 0.04 taper; 40, 0.04 taper; and 50,0.04 taper were used with an electric motor (SilverVDW) according to the manufacturer instructions. Each set of instruments was used for preparation of three root canals and then discarded.

The roots were positioned in a custom-made specimen holder in which they were aligned perpendicularly to the beam and scanned using CS9300 CBCT scanner (Carestream Healthcare India(P) Ltd, India) in the high resolution dental mode (i.e. 90 micron resolution) at coronal, middle and apical third of the root canal Fig 2. After obtaining scans from all specimens, the data from CBCT were stored in magnetic optical disc. The percentage area of residual filling material at cross-sections within the canals was analyzed using the On Demand 3D App software

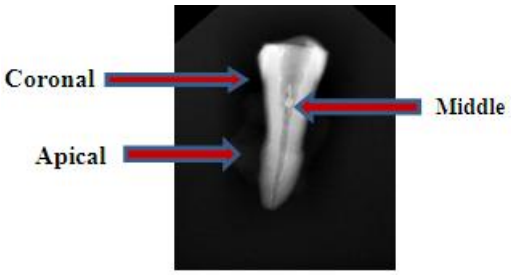


Figure 2: Remaining Gutta Percha

III. Results

Remnants of filling material were observed in all samples regardless of the groups examined. Table 1 shows the amount of remaining obturating material in three groups. The data was statistically analysed using SPSS version 18.0 software and tested using One Way ANOVA (Graph 1) test followed by Bonferroni correction. A p value of 0.05 was considered to be statistically significant. These results demonstrated that group I (reciprocating technique with the Reciproc R50 instrument) (Fig 3) left significantly less remaining material compared with group II (hand files) (Fig 4) and group III (rotary technique with Mtwo R instruments) (Fig 5) ($p<0.05$). Maximum amount of remaining filling material was seen with M two rotary technique which was also statistically significant. Maximum amount of Gutta-percha was found at coronal third and least in apical third of the root canal in all the groups.

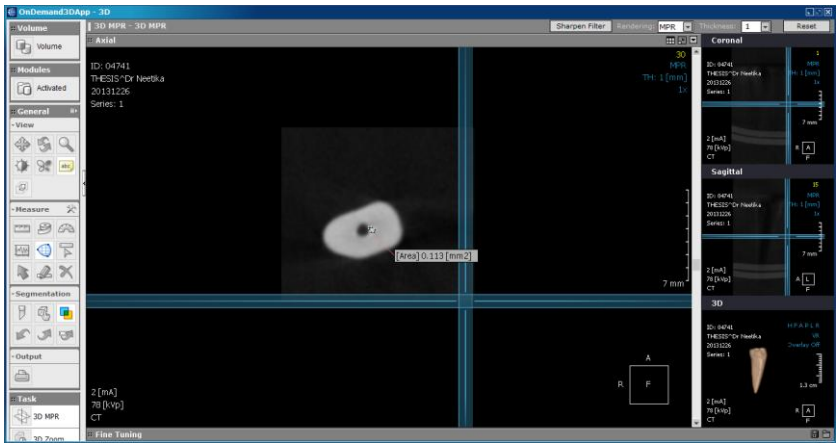


Figure 3: Amount of remaining gutta percha with Reciproc file

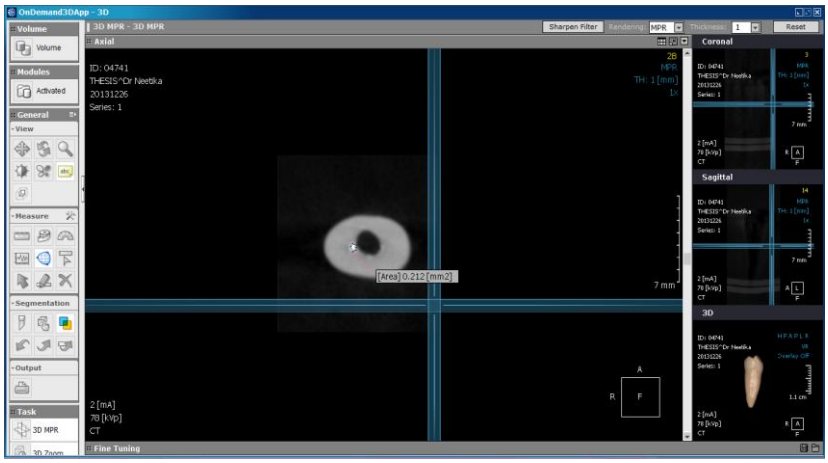


Figure 4: Amount of remaining gutta percha with Gates glidden and hand files

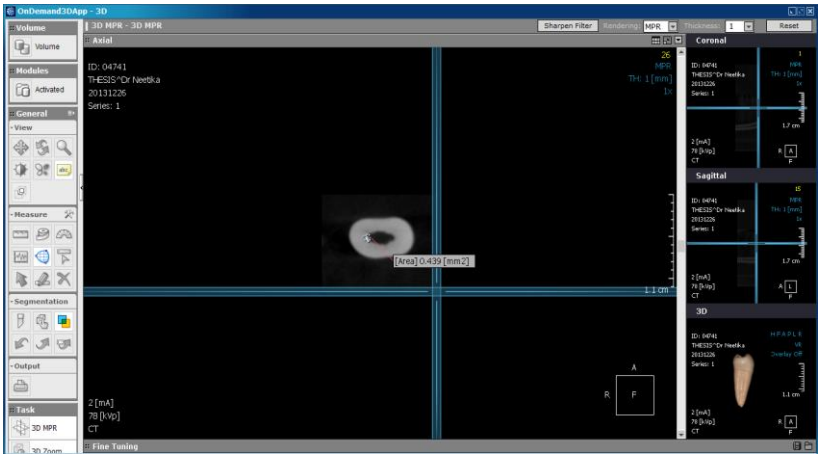
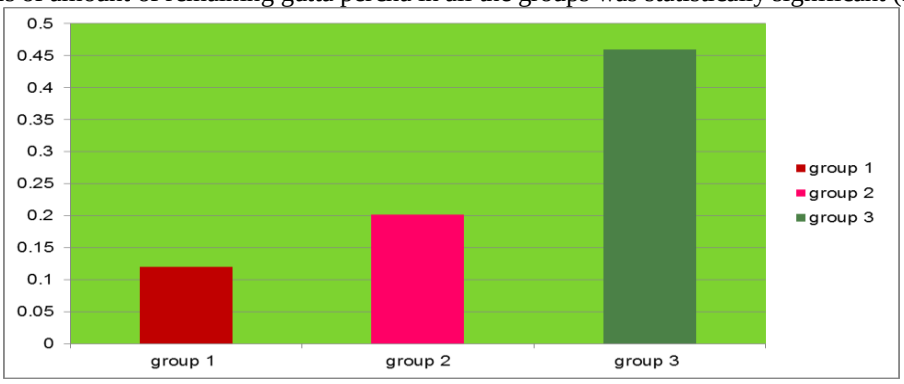


Figure 5: Amount of remaining gutta percha with M Two R file

Table 1: Descriptive analysis between the groups- Amount Of Remaining Gutta Percha In All The Groups

	Group I (reciproc)(%)	Group II (hand file)(%)	Group III (Mtwo)(%)
Coronal third	0.12±0.01	0.20±0.15	0.46±0.03
Middle third	0.03±0.02	0.02±0.01	0.25±0.03
Apical third	0.02±0.00	0.11±0.00	0.25±0.09

The means of amount of remaining gutta percha in all the groups was statistically significant (P<0.05)



Graph 1: Graphic Statistical Analysis –One way ANOVA
Group 1: **Reciproc** Group 2: **GG & Hand File** Group 3: **M Two**

IV. Discussion

The main goal of retreatment is to remove all filling material in the root canal and regain access to the apical foramen, thereby enabling the insertion of new endodontic procedures and the subsequent restoration of health of the periapical tissues. Insufficient removal of filling material impairs the removal of necrotic tissue or remnant bacteria in the root canal which leads to a failure.

In this study, cone beam computed tomography was used to outweigh the limitation of the methodologies previously applied in endodontic retreatment studies, such as displacement of the filling debris during cleavage and two-dimensional imaging on a three-dimensional structure in a non-invasive manner.

Anterior teeth were selected because in these, root canals were usually straight so there were less chances of variations in result while analyzing the efficacy of different rotary and reciprocating technique in removing gutta-percha. In recent years, the use of nickel-titanium (NiTi) rotary files and automated root canal devices has been increasing in endodontic treatments. The advantages of rotary NiTi instruments over hand instruments include facilitating canal preparation, preserving the shape of curved canals and producing smooth surfaces in lesser time than with manual instruments. The single use of endodontic instruments was recently recommended to decrease instrument fatigue and possible cross contamination, cost effectiveness and reducing the number of NiTi rotary instruments required for canal preparation.

Reciproc instrument (VDW, Munich, Germany) is made of standard NiTi alloy with M-wire treatment. Three sizes are available (R25, R40 and R50) to be used according to the initial canal diameter. The taper of the instrument varies along its shaft, with the last 3 mm from the tip presenting a taper of 0.08, 0.06 and 0.05 mm for the R25, R40 and R50 instruments, respectively. The Reciproc instrument is adapted to a motor and operates in a reciprocating movement of 10 cycles per second. Every three reciprocating cycles permit the instrument to rotate 360^0. The Mtwo endodontic instruments introduced in 2005 have two blades and feature a large groove between them. Its increasing pitch allows a more delicate cutting action at the apex and a more aggressive one in the coronal portion. M-wire is a NiTi alloy prepared by a special thermal process that is claimed to increase flexibility and resistance to cyclic fatigue [4].

Hand instrumentation technique was chosen as the control group because it is a well-known and widely used technique. The present study compared these new techniques with the ultimate aim of establishing whether they are able to remove filling material from root canals more effectively than other methods. In this study, none of the three techniques completely removed the filling material from the canal walls in any of the samples. This finding agrees with several previous studies [5-14].

The results revealed that the Reciproc instrument (group I) was most effective in removing gutta-percha. The better performance of Reciproc instrument may be attributed to their design. The reciprocating movement relieves stress on the instrument and, therefore, reduces the risk of cyclic fatigue caused by tension and compression and hence more removal of gutta percha [15].

The Mtwo R rotary files (group III) was significantly least effective in removing guttapercha. Similar results were found in previous studies also [16, 17]. Zuolo et al also observed better result with Reciproc as

compared to M two rotary and hand file [16]. In Contrary good result with M Two were also seen [11]. They explained that the distance between cutting edges (pitch) is increased from the tip of the instrument to the handle. The depth of the space designed for dentine removal is increased behind the blades, which provides the largest space for dentine removal and leads to more efficient gutta-percha removal. But they compared M Two R with R Endo only and not with Reciproc file. Foschi et al demonstrated M two files to be more efficient compared to ProTaper in canal cleaning [18]. This may have occurred because the taper of the rotary instruments was not sufficient to contact all the canal walls, even with circumferential movement. On the other hand, the Hedström files were used against the walls, removing the debris on the walls in the cervical third. The design of the flutes of the Hedström files also facilitates gutta- percha removal. Among the rotary systems now available, Mtwo files® (VDW, Munich, Germany) have yielded similar results in comparison to other rotary systems in cleaning and preparing permanent root canals.[19,20] Rios et al also observed that Reciproc and WaveOne reciprocating systems were as effective as the ProTaper Universal retreatment system for gutta-percha and sealer removal [13]. Maximum amount of Gutta-percha was found at coronal third and least in apical third of the root canal in all the groups.This might be explained due to more amount of Gutta- percha in the coronal third and the difference between the protaper Gutta- percha and the taper of the rotary files used to remove Gutta –percha. Further research is required to compare the amount of remaining filling material at different levels of root canal using other instrumentation systems.

V. Conclusion

Within the limitation of this study

- It can be concluded that none of the file is able to remove the gutta –percha completely.
- Reciproc file may be a good alternative for removal of the gutta-percha.

References

[1]. Betti LV, Bramante CM. Quantec SC rotary instruments versus hand files for gutta-percha removal in root canal retreatment. Int Endod J 2001;34:514-9.

[2]. Giuliani V, Cocchetti C, Pagavino G. Efficacy of ProTaper Universal retreatment files in removing filling materials during root canal retreatment. J Endod 2008;34:1381-4.

[3]. Bonaccorso A, Cantatore G, Condorelli GG, Schäfer E, Tripi TR. Shaping ability of four nickel-titanium rotary instruments in simulated S-shaped canals. J Endod 2009;35:883-6.

[4]. Rödig T, Reicherts P, Konietschke F, Dullin C, Hahn W, Hülsmann M. Efficacy of reciprocating and rotary NiTi instruments for retreatment of curved root canals assessed by micro-CT. Int Endod J 2014;47:

[5]. Saad AY, Al-Hadlaq SM, Al-Katheeri NH. Efficacy of two rotary NiTi instruments in the removal of guttapercha during root canal retreatment. J Endod 2007;33:38–41.

[6]. Tasdemir T, Er K, Yildirim T, Celik D. Efficacy of three rotary NiTi in removing gutta-percha from root canals. Int Endod J 2008;41: 191–6.

[7]. Mello JE Jr, Cunha RS, Bueno CES, Zuolo ML. Retreatment efficacy of gutta-percha removal using microultrasonics: part I - an ex vivo study. Oral Surg, Oral Med, Oral Pathol, Oral Radiol Endodontol 2009;108:59–62.

[8]. Marfisi K, Mercade M, Plotino G, Duran-Sindreu F, Bueno R, Roig M. Efficacy of three different rotary files to remove gutta-percha and Resilon from root canals. Int Endod J 2010;43:1022–8.

[9]. Kfir A, Tsesis I, Yakirevich E, Matalon S, Abramovitz I. The Efficacy of five techniques for removing root filling material: microscopic versus radiographic evaluation. Int Endod J 2012;45:35–41.

[10]. Marques da Silva B, Baratto-Filho F, Leonardi DP, Henrique Borges A, Volpato L, Branco Barletta F. Effectiveness of ProTaper, D-RaCe, and Mtwo retreatment files with and without supplementary instruments in the removal of root canal filling material. Int Endod J 2012;45: 927–32.

[11]. Mollo A, Botti G, Prinicipi Goldoni N, Randellini E, Paragliola R, Chazine M, Ounsi HF, Grandini S. Efficacy of two Ni-Ti systems and hand files for removing gutta-percha from root canals. Int Endod J 2012;45: 1–6.

[12]. R€odig T, Hausd€orfer T, Konietschke F, Dullin C, Hahn W, H€ulsmann M. Efficacy of D-RaCe and ProTaper Universal Retreatment NiTi instruments and hand files in removing gutta-percha from curved root canals - a microcomputed tomography study. Int Endod J 2012; 45: 580–9.

[13]. Rios Mde, Villela AM, Cunha RS, Velasco RC, De Martin AS, Kato AS, Bueno CE. Efficacy of 2 Reciprocating Systems Compared with a Rotary Retreatment System for Gutta-percha Removal. J Endod 2014;40(4):543-6.

[14]. Fruchi LC, Ordinola-Zapata R, Cavenago BC, et al (2014) Efficacy of reciprocating instruments for removing filling material in curved canals obturated with a single-cone technique: a micro-computed tomographic analysis. Journal of Endodontics 2013;40:epub 2014 Jan 17.

[15]. Xu LL, Zhang L, Zhou XD, Wang R, Deng YH, Huang DM. Residual filling material in dentinal tubules after gutta-percha removal observed with scanning electron microscopy. J Endod 2012;38: 293–6.

[16]. Zuolo AS, Mello JE Jr, Cunha RS, Zuolo ML, Bueno CE. Efficacy of reciprocating and rotary techniques for removing filling material during root canal retreatment. Int Endod J 2013;46(10):947-53.

[17]. Bramante CM, Fidelis NS, Assumpcao TS, Bernardineli N, Garcia RB, Bramante AS, de Morais IG. Heat release, time required, and cleaning ability of MTwo R and ProTaper universal retreatment systems in the removal of filling material. J Endod 2010;36: 1870–3.

[18]. Foschi F, Nucci C, Montebugnoli L, Marchionni S, Breschi L, Malagnino VA. SEM evaluation of canal wall dentine following use of Mtwo and ProTaperNiTi rotary instruments. Int Endod J 2004;37:832-9.

[19]. Kuzekanani M, Walsh L, Yousefi MA. Cleaning and shaping curved root canals: Mtwo vs Protaper instruments, a lab comparison. Indian J Dent Res; 20: 268-70.

[20]. Veltri M, Mollo A, Mantovani L, Pini P, Balleri P, Grandini S. A comparative study of Endoflare-Hero Shaper and MtwoNiTi instruments in the preparation of curved root canals. Int Endod J 2008;38:610-6.