



## Original Research Article

## A comparative evaluation of removal of gutta percha using two retreatment file system: An in vitro study

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## ARTICLE INFO

## Article history:

Received 07-03-2020

Accepted 30-04-2020

Available online 25-05-2020

## Keywords:

Retreatment

GuttaPercha solvents

TwoR files

REndo

Scanning electron microscope

## ABSTRACT

**Aim:** A comparative evaluation of the efficiency of two retreatment file systems in removing Gutta-percha from the root canals.

**Materials and Methods:** Forty mandibular premolar teeth with single roots were specifically collected and decoronated with diamond disc so that the root lengths were standardized.

Working length (WL) determination was done and root canal preparation done using Hyflex CM rotary files which was followed with meticulous irrigation and obturation was performed with gutta-percha, by the lateral condensation technique.

AH-Plus sealer was used. The specimens were then divided in a random manner into two groups, in which retreatment was performed using two retreatment systems, Mtwo and REndo. These were further subdivided into two subgroups groups, i.e. one group using root canal solvent and another without solvent. Retreatment will be considered accomplished when gutta-percha was fully removed from the canal and none could be observed on the retreatment instruments and the same was confirmed radiographically. Longitudinally sectioning was done to split the root in to two halves-Mesial & Distal and was observed for the remnants under scanning electron microscope with 40x and 100x magnification. Photographs of the specimens were taken using a digital camera and the area of the remaining obturating material was determined using the AutoCAD16 software.

**Result:** The area of remaining guttapercha in mesial and distal half for all the samples were evaluated using the Autocad software (Version 2016) and the mean as well as standard deviation of each group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Statistical analysis was done using factorial ANOVA and Tukey HSD Post Hoc test. Difference between two groups was determined using student t-test and the level of significance was set at  $p < 0.05$ .

**Conclusion:** The results revealed that Mtwo R file system was found to be a more efficient rotary system for endodontic retreatment when compared to REndo ( $p < 0.05$ ) and use of solvent acts as an adjunct for retreatment in both file systems ( $p < 0.05$ ).

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### 1. Introduction

The primary aim of root canal retreatment is the total elimination of the previous obturating materials<sup>1</sup> which is to be followed with complete re-cleaning and re-shaping and finally a three dimensional obturation of the root canal system. In endodontic practice, gutta-percha is the

frequently used obturation material. Gutta perch from the root canals can be removed by gutta percha solvents, h files, retreatment files, ultrasonic instruments, lasers, heated instruments etc.<sup>2</sup>

Rotary instruments are becoming popular and most dentists prefer them to hand instrumentation techniques as they are less time consuming.<sup>3</sup> Mtwo R rotary files (Sweden & Martina) and the R-Endo (Micro Mega, France) are the

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novel file systems specifically designed for retreatment. Solvents such as chloroform, xylene, oil of orange, benzene, etc are also used, which dissolves the gutta-percha cones and facilitates faster access to the working length and their application along with specific retreatment rotary systems might improve canal cleanliness. A fluid-impervious hermetic seal within the root canal system is important for the long-term success of a root canal therapy.<sup>4</sup> Root canal sealers when used along with the materials for obturation help to establish a good impervious seal of the root canals.<sup>5</sup> AH plus is a resin based sealer containing a non-toxic hardener, and was used in this study.

If the obturating material is compacted well then their removal using hand files can be quite a hazardous task.<sup>6</sup> Hence the use of Ni Ti rotary instruments is becoming popular which decreases patient and operator's fatigue. Various retreatment rotary files are commercially available, Mtwo and R-Endo are the most popular for retreatment. In this study we are comparing the ability of two retreatment file systems in removing the gutta-percha from the root canals with and without the help of gutta-percha solvent, using the help of scanning electron microscope.

## 2. Materials and Methods

Forty extracted mandibular premolar teeth, were collected and cleaned of any tissue remnants, plaque and calculus on the roots with periodontal scalers. Radiographs were taken using cone shift technique (20° mesial shift) to confirm the absence of variations in anatomy.<sup>7</sup> Distilled water was used for storage until further use. Decoronation of all the teeth were done with diamond disc and remaining root length was standardized at 14 mm.

### 2.1. Specimen Preparation

ISO 10 K-file, was passively introduced into the root canal to record the working length (WL). The file was introduced until its tip was seen emerging from the major apical foramen. The length was noted and the working length was calculated by reducing 1mm from this value. Biomechanical preparation was done using Hyflex CM rotary files. Coronal enlargement was done with SX file followed by Hyflex files in sequential order and enlarged upto 6/25. During shaping and cleaning each canal was irrigated with 2.5% sodium hypochlorite (NaOCl) via 27 gauge needle during each instrumentation. A final irrigation was done with EDTA and 2.5% sodium hypochlorite, which was followed by a flush with distilled water.<sup>8</sup> Then drying of the canals were done with paper points. Obturation was done with gutta-percha by the lateral condensation technique. AH Plus was the sealer used. Heated plugger was used to carefully remove 2mm of gutta-percha from the coronal portion and was condensed. In order to appreciate the quality and apical extent of the obturation, radiographs were taken. The

samples were kept at a temperature of 37 degree Celsius and cent percent humidity for 24 hours for the complete setting of the sealer.

### 2.2. Retreatment procedure

The specimens were randomly divided into four groups with 10 samples in each group.

### 2.3. Group A (R-Endo retreatment files)

In accordance with the instructions of the manufacturer, R-Endo retreatment files were used in brushing and circumferential filing. The first file to be instrumented was the Rm stainless steel manual file (17 mm, 25/.04 taper) which was used to its full working length. The second instrument to be used was the nickel-titanium instrument Re (25/.12 taper) orifice opener, R1 (25/.08 taper) till cervical third, R2 (25/.06 taper) till middle third, and finally R3 (25/.04 taper) to full working length. Speed was 300 rpm for 1 minute for each file and a torque of 1.2 N cm.

### 2.4. Group B (R-Endo retreatment file with solvent)

R-Endo retreatment files were used in the above same manner in combination with 2-3 drops of the gutta-percha solvent (Endosolv-R), before the insertion of R-Endo retreatment files.

### 2.5. Group C (Mtwo retreatment files)

The Mtwo retreatment files used in the root canals as per manufacturer's instruction, i.e. first file upto the working length using Mtwo M1 15/.05 taper Max. torque (0.3 Ncm) and next with M2 25/.05 taper Max. torque (1.2 Ncm).

### 2.6. Group D (Mtwo retreatment files with solvent)

The Mtwo retreatment files were used with EndoSolv-R solvent (2-3 drops) and was kept inside the canal for 5 minutes. The canals were then instrumented in a simultaneous manner upto the working length.

In all the groups the root canals were irrigated with 5.25% NaOCl after every instrumentation. Retreatment was considered successful when gutta-percha was fully removed from the canal and the retreatment instruments came out clean and the same was confirmed radiographically.

### 2.7. Scanning Electron Microscopy evaluation

Longitudinally sectioning was done from buccal to lingual surface with the help of diamond disk, and roots were split into mesial and distal halves using chisel and a mallet.<sup>9</sup> Each of the halves were observed for the remnants under scanning electron microscope with 40X magnification. Photographs were taken with a digital camera and loaded to the AutoCAD 2016 software for

evaluating remaining area of root canal filling material.



Fig. 1:

### 3. Results

In the present study, the mean area of remaining obturating material was observed. In group A (REndo), it was  $402.75 \pm 75.98$ ,  $370 \pm 93.48$  and  $96.65 \pm 5.88$  in coronal, middle and apical third respectively. In group B (REndo with solvent), mean area of remaining obturating material in coronal, middle and apical third was  $307 \pm 41.31$ ,  $284 \pm 47.39$  and  $74.4 \pm 6.9$  respectively.

The mean area of remaining obturating material in group C (MTwo) was  $236 \pm 37.34$ ,  $225 \pm 22.44$  and  $64.82 \pm 10.86$  in coronal, middle and apical third respectively. In group D (MTwo+solvent), mean area of remaining obturating material in coronal, middle and apical third was  $108.65 \pm 35.73$ ,  $129 \pm 19.22$  and  $50.93 \pm 7.33$  respectively. On comparison of area of remaining guttapercha between group A, group B, group C and group D at coronal, middle and apical was found least in group D (MTwo+solvent) followed by MTwo and highest in group A (REndo) followed by group B (REndo+Solvent) in coronal, middle as well as apical. ANOVA test was applied to compare the mean area of remaining obturating material among all the four

groups, it was found to be statistically significant as  $p < 0.05$ . Tukey HSD post hoc test was also implicated to see whether any statistically difference exists among the groups with each other or not. It showed that when all the groups were compared with each other in relation to area of remaining filling material, it was found to be statistically significant and hence it can be concluded that with respect to the mean area of remaining guttapercha MTwo+solvent (group D) was the best followed by Mtwo (Group C), R-Endo+solven(Group B) and R-Endo (Group A).

### 4. Discussion

Nonsurgical endodontic retreatment is the initial choice of treatment for the management of endodontic failures.<sup>10</sup> Removal of maximum obturating material from inadequately treated root canal system is very crucial as it discloses the necrotic tissue remnants, microorganisms which may be reason for retreatment procedure. Eventhough the initial endodontic therapy has been shown to produce good prognosis due to various reasons, failures may occur.<sup>11</sup>

According to Dadresanfar et al<sup>12</sup> (2011) among the different retreatment file systems, Mtwo retreatment files are the most efficient in removing obturating material and according to C.Yadav et al<sup>13</sup>(2016)R-Endo retreatment system had the best efficiency towards removing guttapercha condensed by different obturating techniques, so in this study these two systems were compared along with additional softening ability of a solvent.

The novel endodontic concepts works with the aid of devices, which can significantly raise the quality of treatments, less procedure steps and reduced time to make treatment more endurable for the patient. Mtwo (VDW) is an efficient NiTi system for rotary endodontics. The three design features offers efficient dentin removal, effective shaping and safe preparation. There is one single sequence for all the canals. All the files are instrumented till the full working length. Mtwo files, during instrumentation, cuts automatically as it moves down apically and also in a lateral direction while employing a brushing file movement. There is no unnecessary loss of tooth material, because a glide path is created for the subsequent instrument.

R-ENDO files are specially designed with respect to taper, pitch and length. This enables a progressive access to every zone of the canal space. R-ENDO includes a stainless steel Rm hand file which breaks the hard layer of the obturating material and the four NiTi instruments in continuous rotating motion for flaring (Re) and then progressive shaping root canal areas (R1, R2 et R3).

The root canal sealer employed is the AH plus sealer. It is a resin based sealer and can penetrate deep into the tubules and exhibit minimal microleakage. Resin based sealers have an advantage in term of radiopacity and biocompatibility as compared to other sealers. AH plus is an epoxy resin containing a non toxichardner. Radioopacity is imparted by

bismuth oxide and it has a strong adhesive property and contracts slightly while hardening. There is no release of toxic formaldehyde during setting. Cho et al mentioned that the bond strength of final restoration is least affected when resin-based sealers were used as compared to eugenol-based root canal sealers.<sup>14</sup> Considering several advantages, AH-plus was used as the sealer material.

To facilitate an easy removal of the obturating material, a gutta percha solvent was used, supplemented by mechanical removal which allows for a proper cleansing of the apical third. n(Rosier et al., 2008).<sup>15</sup> In this study the efficiency of two different retreatment file systems were evaluated with and without solvent. Solvent used in this study was as Endosolv R which contains formamide and Phenetylalcohol, designed for softening resin-based pastes is likely to result in better resin sealer removal. Endosolv facilitates the removal of zinc-oxide eugenol based and phenolic resin based root canal sealers.<sup>16</sup> Its efficient solvent action enables better sealer removal and protects from the disadvantages associated with the use of power driven instruments for removal. Endosolv eliminated the need for the two previous septodont products (Endosolv E and Endosolv R) thereby a single product is needed for both resin sealer and eugenol based sealer removal. According to PR Shenoi, GBadole et.al<sup>17</sup> Endosolv was more effective to remove resin based sealer (AH Plus) in a short time span.

Various methods are there to assess the root canal debridement after retreatment. Among these the most common method is the longitudinal sectioning of the roots and the remaining root canal filling material can be visualised in the split mesial and distal half. All of the used techniques had its limitations. Schirrmeister et al., reported that residual material might be lost by splitting the roots longitudinally.<sup>18</sup>

In previous retreatment studies remaining guttapercha was assessed radio graphically but here a three dimensional visualization of the root canal system gives a more reliable understanding of the distribution of the gutta-percha after retreatment. Takahashi et al reported that a radiographic examination provides a two-dimensional image, which was proved to be less effective than cleavage method.<sup>19</sup>

According to Eduardo et al, scanning electron microscope can analyse even the presence of filling material penetrated inside the dentinal tubules during condensation, hence the scanning electron microscope was preferred in the study.<sup>20</sup> Both 100x and 40x magnifications were taken but the latter was used for calculating the area of the remaining filling material. The AutoCAD 2016 software have been used for evaluating area of remaining obturating material. The outcome was a measure of the area of remaining obturating material, measured in square millimetre (mm<sup>2</sup>) and the objective was to compare the outcome measure (area of remaining obturating material) among the these four groups. The group which had the least amount of guttapercha was considered to have the maximum efficiency in removing the obturating material.

According to mean area of remaining obturation material Group D had the least, followed by Group C, Group B and Group A (i.e. Group D < Group C < Group B < Group A). Therefore to conclude the efficacy of MTwo+solvent was the best in removing gutta-percha followed by Mtwo used alone, then REndo with solvent and REndo used alone.

## 5. Conclusion

Under the conditions of the present ex-vivo study, MTwo R files are more efficient in removing guttapercha from the root canal walls compared to the REndo files and also Endosolv R as a solvent adjunctly helps in increasing the efficiency of MTwo R files.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

## References

1. Sundqvist G. Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment. *Oral surg Oral Med Oral Pathol Endod.* 1998;85:86-93.
2. Torabinejad M, Corr R, Handysides R, Shahbahang S. Outcomes of Nonsurgical Retreatment and Endodontic Surgery: A Systematic Review. *J Endod.* 2009;35:930-7.
3. Somma F, Cammarota G, Plotino G, Grande NM, Pameijer CH. The Effectiveness of Manual and Mechanical Instrumentation for the Retreatment of Three Different Root Canal Filling Materials. *JOE.* 2008;34:466-9.
4. Bergenhol G, Lekholm U, Milthorpe R, Heden H, Odesjö B, Engström B, et al. Retreatment of endodontic fillings. *Eur J Oral Sci.* 1979;87(3):217-24.
5. Masiero AV, Barletta FB. Physicochemical properties of epoxy resin based and bioceramic based sealer. *Int Endod J.* 2005;38(1):2-7.
6. Filho MT, Td O. Bortoluzzi EA, evaluate the effectiveness of 3 solvents (eucalyptol, orange oil, and xylol) on 2 types of gutta-percha (conventional and thermoplastic) and Resilon. *BDJ.* 2010;21(1):46-9.
7. Hulsman T. Efficacy, cleaning ability and safety of different devices for gutta-percha removal in root canal retreatment. *Int J Endod;*30:227-33.
8. Imura N, Kato AS, Hata GI, Uemura M, Toda T, Weine F, et al. A comparison of the relative efficacies of four hand and rotary instrumentation techniques during endodontic retreatment. *Int Endod J.* 2000;33(4):361-6.
9. Somma F, Cammarota G, Plotino G, Grande NM, Pameijer CH. The Effectiveness of Manual and Mechanical Instrumentation for the Retreatment of Three Different Root Canal Filling Materials. *J Endod.* 2008;34(4):466-9.
10. Imura N, Pinheiro ET, Gomes B. et al The outcome of endodontic treatment. *J Endod.* 2007;33:1278-82.
11. Saad AY, Al-Hadlaq SM, Al-Katheeri NH. Efficacy of Two Rotary NiTi Instruments in the Removal of Gutta-Percha During Root Canal Retreatment. *J Endod.* 2007;33(1):38-41.
12. Dadresanfar B, Mehrvarzfar, Saghiri MA, Ghafari S, Khalilakz. Vatanpour M Efficacy of Two Rotary Systems in Removing Gutta-Percha and Sealer from the Root Canal Walls. *Iranian Endod J.* 2011;6(2):69-73.
13. Chakravarthy Y, Divya V. Comparative evaluation of the efficiency of the R-Endo retreatment system in removing the root canal

- obturations with gutta-percha using two different obturation techniques. *Int Endod J.* 2006;39(10):779-84.
14. Cho JY, Jin MU, Kim YK, Kim SK. The influence of AH-26 and zinc oxide-eugenol root canal sealer on the shear bond strength of composite resin to dentin. *J Korean Acad Conserv Dent.* 2006;31:147-52.
  15. Rosier MAA, Debruyne RJG, Moore D. Solubility of AH-26 at different consistencies using Endosolv E and R root filling removers. *Int Endod J.* 2005;38:939.
  16. Wourms DJ, Campbell AD, Hicks ML, Pelleu GB. Alternative solvents to chloroform for gutta-percha removal. *J Endod.* 1990;16(5):224-6.
  17. Shenoi PR, Badole GP, Khode RT. Evaluation of softening ability of Xylene & Endosolv-R on three different epoxy resin based sealers within 1 to 2 minutes - an in vitro study. *Restor Dent Endod.* 2014;39:17-23.
  18. Schirmermeister JF, Hermanns P, Meyer KM, Goetz F, Hellwig E. Detectability of residual sealer and gutta-percha after root canal retreatment using a dental operating microscope and radiographs - an ex vivo study. *Int Endod J.* 2006;39(7):558-65.
  19. Takahashi CM, Cunha RS, Martin ASD, Fontana CE, Silveira CFM, da Silveira Bueno CE, et al. In Vitro Evaluation of the Effectiveness of ProTaper Universal Rotary Retreatment System for Gutta-Percha Removal with or without a Solvent. *J Endod.* 2009;35(11):1580-3.
  20. Hammad M, Qualtrough A, Silikas N. Three-dimensional Evaluation of Effectiveness of Hand and Rotary Instrumentation for

Retreatment of Canals Filled with Different Materials. *J Endod.* 2008;34(11):1370-3.

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**Cite this article:** Sunil SM, Rajkumar B, Gupta V, Bhatt A, Paliwal P. **A comparative evaluation of removal of gutta percha using two retreatment file system: An in vitro study.** *IP Indian J Conserv Endod* 2020;5(1):53-57.