

THE EFFICACY OF WAVEONE GOLD AND MTWO RETREATMENT FILES IN THE REMOVAL OF CARRIER-BASED GUTTA-PERCHA OBTURATORS

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ABSTRACT

Aim of the study To compare the efficiency of two rotary nickel-titanium (NiTi) systems: MTwo Retreatment (VDW GmbH, München, Germany) and WaveOne Gold (Dentsply Maillefer, Ballaigues, Switzerland) in the removal of two different carrier-based gutta-percha (GP) obturators. Material and methods 12 plastic blocks with simulated root canals were shaped, cleaned and obturated: 6 with GuttaCore® (Dentsply Maillefer) and 6 with GUTTAFUSION® (VDW). After one week, each group was divided into two subgroups and WaveOne Gold (WOG) and MTwo R (MTR) were used in the removal of GP from 3 samples of each carrier type. The time was recorded, photographs were taken and scores for remaining gutta-percha were attributed at the end of retreatment. The area of each retreated canal was compared with the total area of the resin block. Results In a similar amount of time, the WOG files were able to remove a higher amount of GP than MTwo R, without significant alteration of the root canal shape. Conclusions Neither of the files could remove entire amount of GP, but WOG proved to be more efficient.

Keywords:

Endodontic Retreatment, WaveOne Gold, Mtwo R, GuttaCore®, GUTTAFUSION®, Carrier-Based obturation

INTRODUCTION

Even with the technological advancements of the last decades that significantly improved the medical treatment's outcome, the endodontic retreatment is still not fully predictable. A recent study has showed that an endodontic treatment of a vital tooth has a 99,4% success rate, a treatment of a necrotic tooth 98,6 and for a retreatment the success rate drops down to 95.6%. [1] Higher success rates were only achievable thorough research, and especially nowadays, when the clinician can choose between a wide variety of instruments and materials, it is very important that every

medical decision has to be made considering scientific evidence.

Endodontic retreatment benefits from a precise list of indications and contraindications, but the clinical decision-making is influenced by a larger number of factors, among which the nature of the endodontic filling is of great importance. Numerous studies have shown that the different outcomes of the endodontic retreatment depend not only on the instruments used, but also on the root canal filling material, [2] that is why each type of endodontic filling should be properly studied.

The Thermafil (Dentsply Maillefer, Ballaigues, Switzerland) technique is well known among clinicians for its simplicity and quality of the obtained filling, but also for the removing difficulty in the case of retreatment or post insertion. [3, 4] The newly developed GuttaCore® (Dentsply) and GUTTAFUSION® (VDW) obturators distinguish themselves by the cross-linked gutta-percha core instead of a plastic or metallic one. This improve solves the encountered clinical difficulties of the Thermafil system, the new core proving to be significantly easier to be removed in both retreatment and post placement cases. [5, 6]

With the improvements of gutta-percha obturators, newly developed mechanical NiTi files were available on the market in order to make endodontic retreatment much easier and faster. Even if not of that much significance for the retreatment outcome as the change of the obturator core, proper endodontic instruments can have a great impact in providing a more qualitative treatment result.

Aim of the study

The purpose of the present study was to compare the efficacy in gutta-percha removal of two mechanical NiTi files, one dedicated rotary retreatment system, well known for its clinical performance, Mtwo R (VDW) and a new and promising reciprocating system, WaveOne Gold (Dentsply), on shaped and cleaned simulated root canals obturated with two types of gutta-percha carriers: GuttaCore (Dentsply) and GUTTAFUSION (VDW).

MATERIAL AND METHODS

Twelve standard resin endodontic training blocks (Dentsply Maillefer, Ballaigues, Switzerland) were used in the present study. Each block was shaped to an apical size of 0.25 mm and a taper of .06 using the ProTaper Next (Dentsply) X1 and X2 instruments. After proper cleaning, shaping and drying, samples were

randomly divided into 2 groups of 6 each, according to the carrier used for obturation. The samples from one group were filled with GuttaCore red obturators together with an epoxidic resin sealer AdSeal (Meta Biomed, South Korea) and the samples from the other group with GUTTAFUSION red obturators and the same sealer. The filling procedure was conducted according to the manufacturer's indications using a Thermaprep Plus oven (Dentsply Maillefer, Ballaigues, Switzerland). After heating the obturators, a small amount of sealer was placed in the simulated root canals with the help of a size 25/.06 X2 paper point (Dentsply) and the heated carrier was introduced inside the canal slowly until the working length was reached. The handle was sectioned manually and gutta-percha was coronally condensed at the orifice with a hand plugger.

After one week, the plastic blocks were retreated in two phases: first, each type of mechanical instrument (WaveOne Gold-WOG or Mtwo R-MTR) was used without any irrigant or solvent until the file reached the working length. In the second phase the canals were cleaned with alcohol and once again the instruments were used alone in order to finish the preparation.

The two groups were therefore divided into halves resulting four groups to be studied, each of 3 samples (n=3) as follows: group I GuttaCore GC – WOG, group II GUTTAFUSION GF – Mtwo R, group III GuttaCore GC – Mtwo R and group IV GUTTAFUSION GF – WOG. From the WaveOne Gold system, only the WOG Primary instrument 25/.07 was used in retreatment by setting the reciprocation function of the Dentsply X-Smart Plus endodontic motor (Dentsply Maillefer). From the Mtwo R set, only the red instrument 25/.05 was used at 600 rpm and a torque of 2 Ncm using the same endodontic motor. The time required to remove the filling material from the root canals was recorded for each block in each

retreatment phase and photographs were taken for each sample before and after each step.

Time evaluation

The time in which the instrument was active inside the root canal during

each retreatment phase (TI and TII) was recorded in minutes and seconds for each NiTi instrument. Table I reveals the corresponding time for the first and second retreatment phases.

Table I. Time measurement for the two-retreatment phases

	I GC - WOG			II GF - MTR			III GC - MTR			IV GF - WOG		
Sample No.	1	2	3	4	5	10	7	8	9	6	11	12
TI (min and sec)	2.05	3.03	2.35	1.12	2.23	0.49	5.25	3.63	1.89	2.45	3.16	5.13
TII (min and sec)	0.39	0.34	0.21	0.30	0.25	0.26	0.22	0.43	0.44	0.27	0.32	0.33

Remaining gutta-percha analysis

To compare the efficacy of the two rotary systems regarding their ability to remove gutta-percha from the filled root canals, the blocks were photographed after each of the two-retreatment phases. On every image the canal was divided into three areas: coronal, middle, and apical third (Fig.1) and each third received a

score according to the amount of gutta-percha still visible in the canal. The scores were given as follows:

- 0=clean canal, without visible gutta-percha
- 1=small traces of gutta-percha
- 2=moderate amount of gutta-percha
- 3=large amount of gutta-percha
- 4=fully obturated area



Figure 1. Aspect of a sample after retreatment and the division in thirds (red lines)

The scores given to each sample for each third after each retreatment phase are recorded in Tables II and III.

Table II. The scores according to the amount of gutta-percha visible in the root canal after the first retreatment phase

I GC - WOG			II GF - MTR			III GC - MTR			IV GF - WOG		
1	2	1	3	2	1	1	2	3	1	2	1
2	3	2	3	3	3	3	3	3	2	1	2
2	2	2	3	3	3	4	3	3	3	2	4

Table III. The scores according to the amount of gutta-percha visible in the root canal at the end of the endodontic retreatment

I GC - WOG			II GF - MTR			III GC - MTR			IV GF - WOG		
0	0	0	1	1	1	0	2	1	0	0	0
1	2	1	2	2	2	3	3	2	2	1	2
0	1	0	2	3	2	4	3	2	3	2	4

Root canal area evaluation

Regarding the changes in the shape of the root canal and the amount of plastic material removed by the files, considering that all samples were prepared to fit the same size gutta-percha obturator, the measurements aimed to reveal possible differences between the final preparations. A set of digital photographs was made at the end of the retreatment and analyzed

with an image-processing program (ImageJ). Because of the errors that could have occurred from different shooting angles, the total area of one side of the block was measured and the final result was calculated as a percentage from the total area. Figure 2 shows the two phases of the measuring process. For a better view of the root canal, methylene blue-dye was introduced inside.

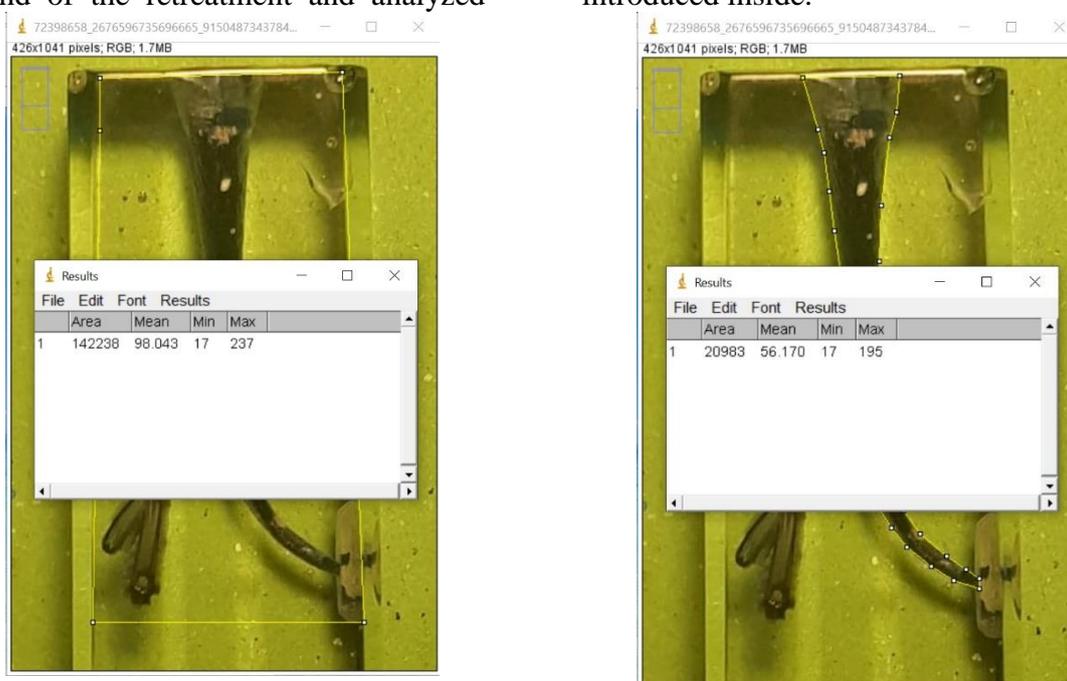


Figure 2. Measurements of the root canal area and of the block surface in ImageJ

RESULTS

Regarding the time needed for the endodontic retreatment, the graphic representation in Figure 3 is offering an overview of the sum of the two phases values for each block.

The shortest time was recorded for group II (GF-Mtwo), closely followed by group I (GC-WOG), with the last two groups at more than double the values of group II.

An ANOVA single factor test was performed with a p-value set at 0.05 to

observe possible differences. The null hypothesis tested was that no statistical significant differences exist between Groups comparing the time needed to remove gutta-percha from the root canals. The results were represented in Table IV. Because the p-value was higher than 0.05 and the F value was smaller than the critical one, the null hypothesis was accepted

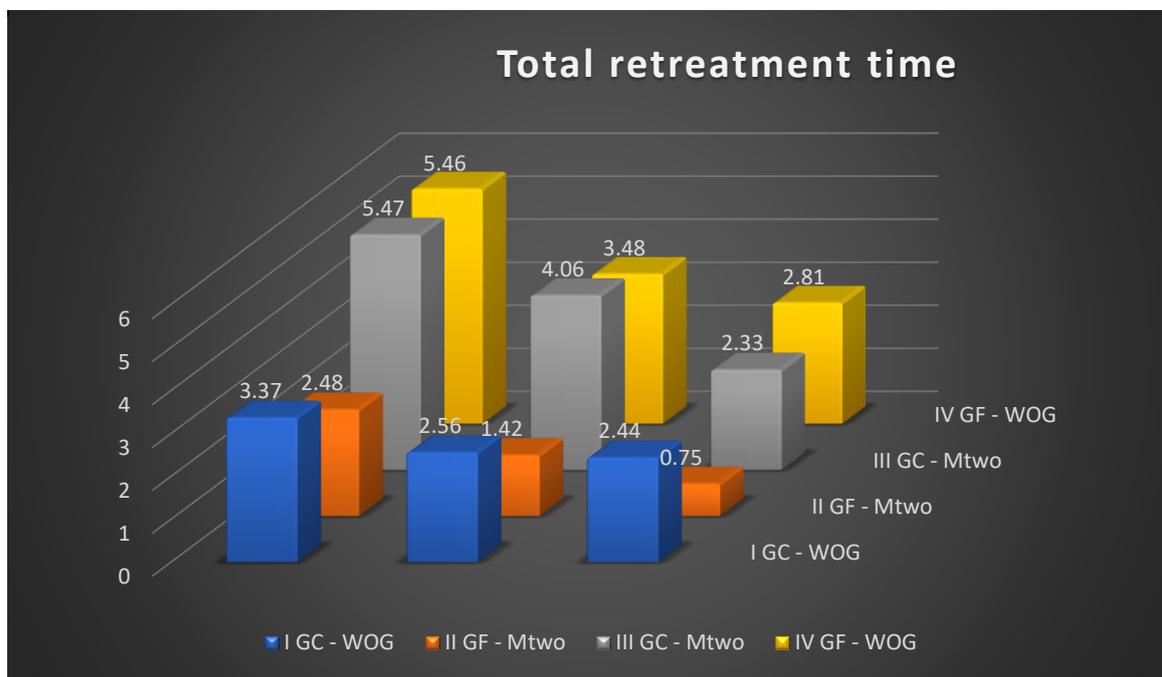


Figure 3. Total needed time for endodontic retreatment/sample/group (min)

Table IV. ANOVA Single Factor test analysis for time measurement

SUMMARY				
Groups	Count	Sum	Average	Variance
I	3	8.37	2.79	0.2559
II	3	4.65	1.55	0.7609
III	3	11.86	3.953333	2.473433
IV	3	11.75	3.916667	1.898633

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	11.65409	3	3.884697	2.883498	0.102701	4.066181

Within Groups	10.77773	8	1.347217
Total	22.43183	11	

Concerning the quantity of the remaining gutta-percha inside the root canals, Figures 4 and 5 display the sum of the scores obtained for each group at the

end of each retreatment phase. WOG performed better in both groups, with especially good results for the removal of GuttaCore obturators.

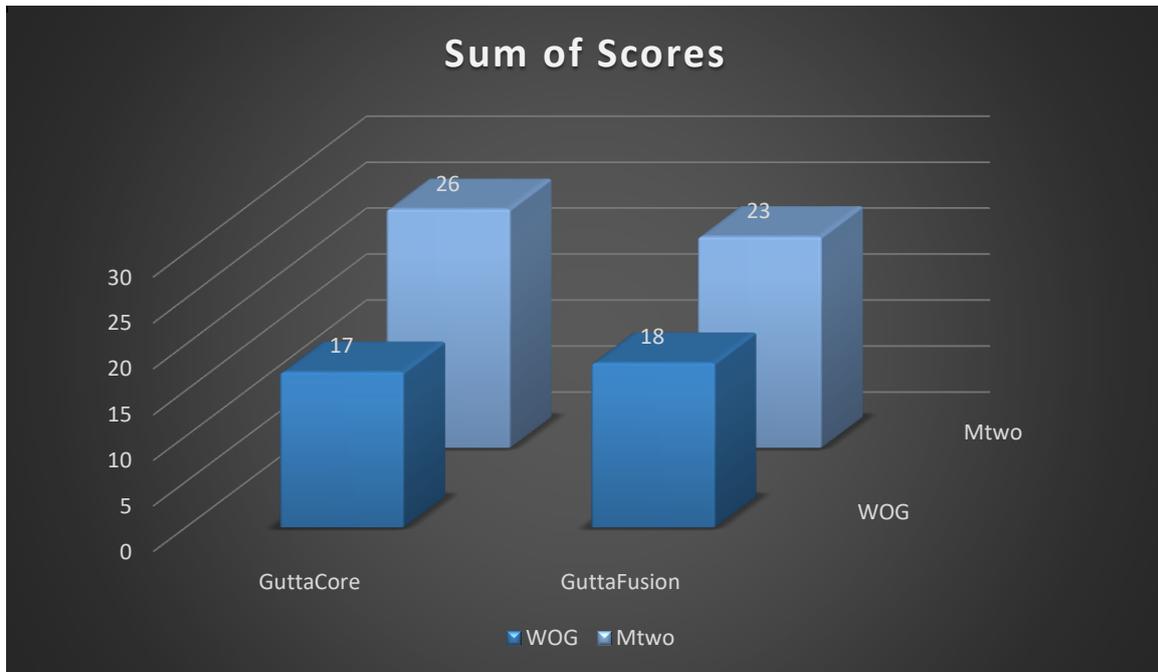


Figure 4. Graphic representation of the scores obtained for the residual gutta-percha still present in the root canals at the end of the first phase for each group

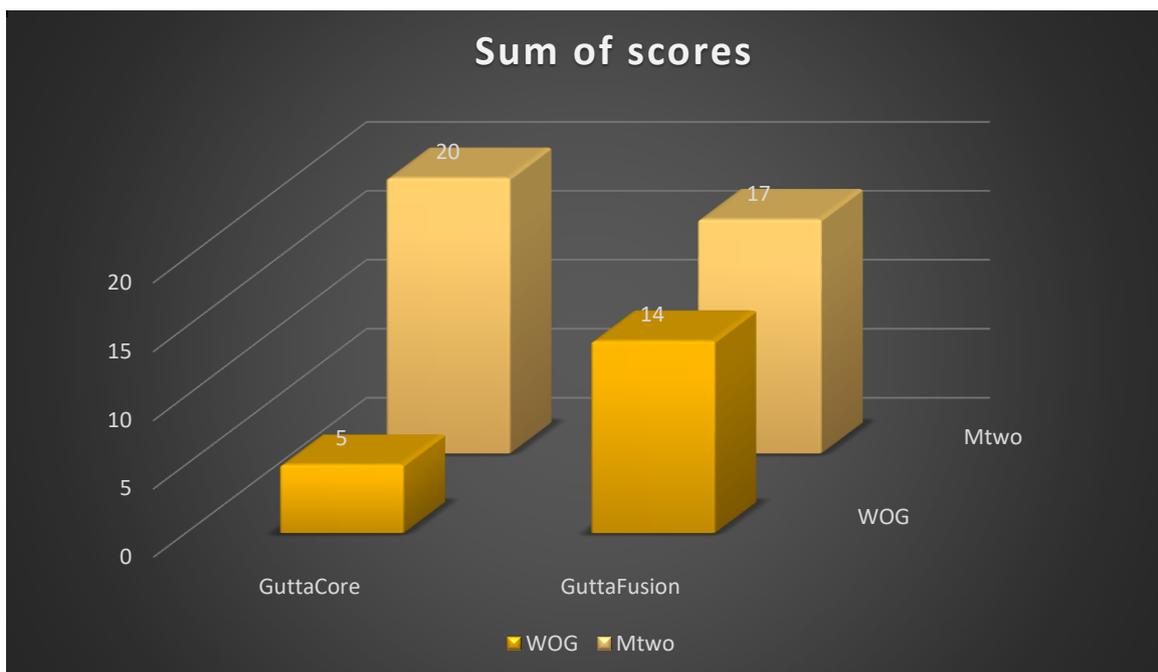


Figure 5. Graphic representation of the scores obtained for the residual gutta-percha still present in the root canals at the end of the retreatment

Relating to the final area analysis, table V shows the percentages from the total block surface area occupied by the canal for each sample at the end of retreatment and the mean values for each

group. No significant differences were recorded, with a maximum difference of 1.35% between Groups I and III respectively.

Table V. Percentages of the root canal area from the total area of the plastic block at the end of the retreatment

I GC - WOG			II GF - MTR			III GC - MTR			IV GF - WOG		
1	2	3	4	5	10	7	8	9	6	11	12
14.75%	15.28%	14.28%	13.55%	15.42%	14.28%	14.70%	13.31%	12.25%	15.01%	13.35%	13.25%
14.77%			14.41%			13.42%			13.87%		

DISCUSSIONS

According to the results of the present study and in conjunction with other clinical data [7], 100% gutta-percha removal is not clinically possible during retreatment in Endodontics.

Reciprocating instruments have proved to possess comparable efficiency to standard rotary files during endodontic retreatment. [8] With the enhances given to the newest WaveOne Gold files in comparison to the old WaveOne (Dentsply Maillefer) instruments, the proven ability of the old system in removing gutta-percha from the root canals could have been improved by the use of the NiTi Gold-alloy. Also, the improved shape memory of WOG could be useful in preventing strips and ledges during retreatment procedures. The parallelogram-shaped cross-section allows also a more efficient removal of debris, and the semi-active tip recommends it for use in endodontic retreatment. [9]

Dedicated retreatment files have been also available on the market and their efficacy in gutta-percha removal is well known. Mtwo R (VDW) is one of the most used retreatment systems along with the ProTaper Universal Retreatment (Dentsply

Maillefer) dedicated one, and these systems were often compared. [10] In the present study, the rotary retreatment file system Mtwo R was compared to a reciprocating one (WOG).

The time needed for endodontic treatment and its predictability have been significantly improved in the past decades and clinicians seek to obtain better clinical results. That's why, single-file rotary systems can be used with maximum predictability in almost any cases, including endodontic retreatment. Furthermore, if the system has a small number of files that can be adapted to a large variety of cases, the procedures are even simpler and possibly less expensive. In addition, WaveOne Gold files are manufactured to ensure proper hygiene conditions for the patient and to reduce the risk of cross-contamination, being of single use.

These reciprocating instruments have been previously studied in comparison with dedicated retreatment files, as being very efficient in basic endodontic treatment and in retreatment cases as well. [8] The similarities between the results obtained in this study of Madarati et al. and the ones reported in the

current study concern the remaining gutta-percha inside the root canal after mechanical preparation. Both studies showed a higher amount of residual gutta-percha after the use of Mtwo R in comparison with other mechanical files. Similar results were also reported in a study by Khedmat et al. [10] Having a taper of .07 in comparison with the .05 of the Mtwo R 25 file, the WOG Primary instrument achieved better results in gutta-percha removal for both GuttaCore and GUTTAFUSION, showing lower scores at the end of retreatment.

As regarding the time needed to remove the root canal filling material, the results of the present study showed no statistically significant differences between the four groups, although less time was recorded in Groups I and II in comparison with the other two. As a supposition, the harder consistency of the gutta-percha from the GUTTAFUSION carrier and the higher speed used for the Mtwo R files may have influenced the outcome for the GF groups in comparison with WOG Primary. For GuttaCore, with a softer consistency core, better results were achieved by using the reciprocating WOG Primary file.

Regarding the quantity of the removed gutta-percha and the time of the retreatment, and the percentage of the root

canal area resulting after retreatment in comparison with the total area of the plastic block, no connections could be made. Although, in Groups I and II a higher percentage from the total area of the resin block was removed in less period of time. Further studies are necessary including a larger number of samples, and more precise measurements of the area modifications of the simulated root canals have to be used.

CONCLUSIONS

Within the limitations of the present study, it can be stated that:

- I. Neither of the two NiTi systems used was able to remove the entire gutta-percha from the root canal.
- II. The WaveOne Gold Primary 25/.07 file managed to remove a higher quantity of gutta-percha in comparison with the Mtwo R 25/.05 file, although not statistically significant different.
- III. Concerning the time needed for retreatment and the quantity of resin removed from the simulated root canal walls no significant differences between the two systems were observed.

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