AL-AZHAR
Dental Journal
For Girls

The Official Publication
of The Faculty of Dental
Medicine For Girls,
Al-Azhar University
Cairo, Egypt.

Print ISSN 2537-0308 • Online ISSN 2537-0316

ADJ-for Girls, Vol. 6, No. 2, April (2019) — PP. 223:229

The Efficacy of Reciprocating Instruments versus Continuous Rotary Nickel-Titanium Instruments in Root Canal Retreatment with Different Filling Materials

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DOI: 10.21608/adjg.2019.5563.1013

ABSTRACT

Purpose: The aim of this study was directed to rate the quality of different

Engine-driven retreatment files: ProTaper Retreatment files, Wave One system and OneShape system in removal of different filling materials. **Material and methods:** Nighty-six freshly extracted mandibular first molars were prepared with universal ProTaper rotary files till size F3 then categorized into two main groups (I and II) on the basis of type of material used in obturation. Group I: obturated with Gutta-percha, Group II: obturated with EndoREZ. Each One of them was categorized into three sub-groups : sub group A, B and C on the basis of the system use (16 each), Subgroup A: using ProTaper Universal retreatment system, Subgroup B: using Wave One file, Subgroup C: using One Shape. Each subgroup was divided into two divisions according to the use of solvent or not (8 each). The residual obturating material was evaluated by the use of the stereomicroscope. **Results:** there was a significance unlikeness among tested groups, subgroups and subdivisions in the percentage of the residual obturating material **Conclusion**: Protaper retreatment instruments and Wave One file remove more filling material in comparison with OneShape file, regardless the amount of residual gutta percha filling material ,it was greater than with EndoREZ, Retreatment without the use of solvent was significantly faster and more effective than with solvent.

KEYWORDS

Retratment, EndoRez, Wave One, OneShape, Universal ProTaper files.

INTRODUCTION

Root canal treatment is a very effective treatment, but the outcome may not be successful and may lead to undesirable results. When the outcome is not satisfactory, retreatment option are available such as refilling of the root canals, preradicular surgery, or it will finally lead to tooth extraction. Nonsurgical retreatment is the safest and most

- Paper extracted from Master thesis titled "efficacy of three different rotary files to remove gutta-percha and Resilon from root canals."

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conservative way in solving the problem. The first purpose of doing retreatment is having straight entry until reaching the apical foramen through removing of obturation material completely, as a result it will make the cleaning and shaping smoother and simpler[1].

It has not been verified that clearing away all the obturating material will guarantee the success of the canal's retreatment and the residual debris will lead to failure[2] . However, clearing away all the obturating material is critical as bacteria and tissue necrosis could be the main reason of periapical diseases and failure.

Different types of obtuarting materials are being used, Gutta-percha with different types of sealers is the most common. However, lately, various resin-based root canal filling materials have been used to preventing microleakage and improving the fracture resistance of root filled teeth.

A variety of retreatment methods are used, including manual hand instruments facilitated by using of gutta-percha solvents such as xylol, halothane, orange oil, eucalyptol, or ultrasonics, Chloroform, lasers, as well as nickel-titanium instruments[3] .

Rotary Ni-Ti files have been evaluated in the retreatment process, the main advantage is less time consuming. Therefore, investigations of using Ni-Ti instruments in the removal of resin filling materials in comparison with conventional gutta-percha are of great value[4] .

MATERIALS AND METHODS

Selection of sample and preparation:

Nighty-six extracted mandibular first molars were selected access was done by round bur and Endo-Z bur in a high-speed hand pieces. The distal roots were resected at the level of the furcation. Measuring the working length was done by subtracting 1mm when the tips of #10 K-files became observed at the apical foramina. Root canal instrumentation: ProTaper Universal rotary Ni-Ti instruments were used in cleaning and shaping with handpiece (C-smart-1 endodontic handpiece) and an electric motor (C-smart -1 Coxo); the speed was set at 250-300 rpm, the torque was adjusted on the basis of manufacturer's guidance, for each file used. Root canal preparation was done starting with Sx file which was used as an orifice opener, followed by S1 file and S2 file then the Finishing files (F1, F2 and F3) were used with up and down movement to the full working length, where F3 used as master apical file. After each instrument use, irrigation with 2.6% NaOCL was done for 30 seconds dispensed through a 25-gauge side vent irrigating needle, the needle was inserted 3mm shorter than the working length, and final rinse was done using 17% EDTA solution to clear away the smear layer.

Samples grouping: After root canal preparation, the samples were classified in two main groups (I and II) on the basis of the type of obturating material (48 each): Group I: Gutta-percha were used in obturation, Group II: EndoREZ. Each group was classified into three subgroups: subgroup A, B and C, and on the basis of the system used in clearing away the obturation material (16 each): Subgroup A: retreatment was done using ProTaper retreatment file. Subgroup B: retreatment was done using Wave One file. Subgroup C: retreatment was done using One Shape file. Each subgroup was divided into two divisions according to the use of solvent or not (8 each). Subdivision 1: The organic solvent was used. Subdivision 2: The organic solvent was not used.

Root canals obturation:

- Group I (gutta-percha): obturation was done by ProTaper gutta-percha points (#F3) by applying the modified single cone technique with ZnO eugenol sealer.
- Group II (EndoREZ): obturation was done by EndoREZ points by applying single cone technique with EndoREZ sealer (resin- based sealer).

EndoREZ sealer was expressed out of the dual barrel syringe with a mixing tip into a mixing bad and delivered into the canal using the master EndoREZ gutta-percha point (#30), The access cavity was sealed with temporary filling and stored at 37ºc in 100% humidity till the completion of sealer setting it will take two weeks.

Retreatment of samples:

Subgroup A: (retreatment with ProTaper retreatment system):

ProTaper retreatment Ni-Ti files were used in root canal filling removal with a reducing handpiece (C-smart-1 endodontic handpiece) and an electric motor (C-smart -1 Coxo); at a rotational speed of 400-500 rpm, the torque was adjusted on the basis of manufacturer's guidance. The ProTaper retreatment set (D1, D2 and D3) were used till reaching the full length.

Subgroup B: (retreatment with Wave One file):

Retreatment was done by using Wave One file that was activated by a pre-programmed motor (C-smart -1 Coxo) operated with a reducing handpiece(C-smart-1 endodontic handpiece). The motor is set on the basis of manufacturer's guidance; the file was used in "reciprocal motion". Wave One primary file (25/08) was used until reaching the full working length in up and down movement with little force.

Subgroup C: (retreatment with OneShape file):

Root canal filling was removed using One Shape file that was activated by a torque-limited electric motor (C-smart -1 Coxo); the torque was adjusted on the basis of manufacturer's guidance, and the speed as well, The OneShape file (25/06) was gently pressed into the obturation material with a picking action in a crown-down direction. In the subgroups which solvents were used, chloroform was used in 0.1 ml and injected as small increments into the canal between retreatment files.

RESULTS

I. Percentage of remaining obturating material on the walls:

- ***Group I: (Gutta-percha):***

With solvent: The mean percentage of residual obturating material on the walls and standard deviation values of subgroup A (ProTaper retreatment system), subgroup B (Wave One file) and subgroup C (One Shape file) were 40.76 ± 7.85, 45.47 ±8.03 and 55.47 ± 8.03 respectively. ANOVA test showed that, it was found that there was a significant unlikeness among the tested subgroups in the mean percentage of residual obturating material.

Without solvent: The mean percentage of residual obturating material on the walls and standard deviation values of subgroup A (ProTaper retreatment system), subgroup B (Wave One file) and subgroup C (One Shape file) were 27.85 ± 6.57, 32.05 ± 7.87and 42.05 ± 7.87respectively. ANOVA test showed that, there was a significant unlikeness among the tested subgroups in the mean percentage of residual obturating material. (Fig.1)

- ***Group II: (Endo REZ):***

With solvent: The mean percentage of residual obturating material on the walls and standard deviation values of subgroup A (ProTaper retreatment system), subgroup B (WaveOne file) and subgroup C (One Shape file) were 27.82 ± 7.54, 29.83 ± 3.39 and 40.83 ± 4.54 respectively. ANOVA test showed that, it was found that there was a significant unlikeness among the tested subgroups in the mean percentage of the residual obturating material.

Without solvent: The mean percentage of residual obturating material on the root canal walls and standard deviation values of subgroup A (ProTaper retreatment system), subgroup B (WaveOne file) and subgroup C (One Shape file) were 21.66 ± 4.28, 25.36 ± 3.80 and 35.36 ± 3.80 respectively. ANOVA test showed that, it was found that there was a significant unlikeness among the tested subgroups in the mean percentage of remaining filling material. (Fig.1)

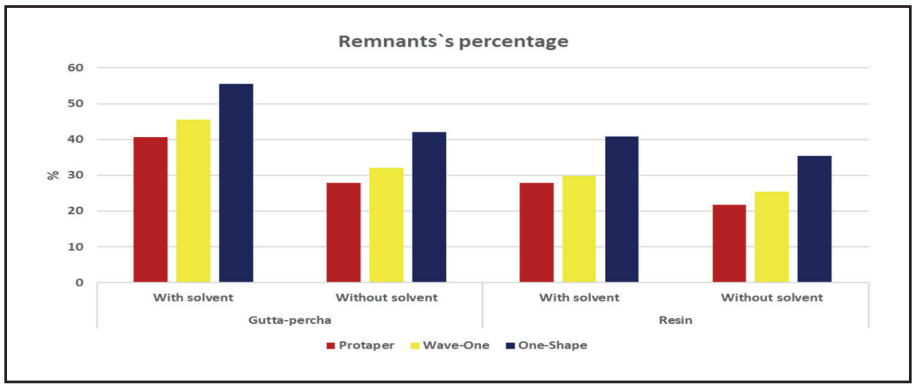

Figure (1): Bar chart showing the effect of type of obturation material on retreatment among ProTaper system, WaveOne and One Shape files with and without solvent.

II) Time required for residual obturating material to be removed.

Group I (Gutta-percha):

With solvent: it was found that there was a significant unlikeness among (ProTaper), (Wave-One) and (One-Shape). A significant unlikeness was observed among (ProTaper) and the two of (Wave-One) and (One-Shape). No significant unlikeness was found among (Wave-One) and (One-Shape). The greatest value was observed in (ProTaper) (542.54 ± 49.35) followed by (One-Shape) (439.34 ± 46.61), while the least mean value was found in (Wave-One) (393.34 ± 51.17).

Without solvent: it was found that there was a significant unlikeness among (ProTaper), (Wave-One) and (One-Shape). A significant unlikeness was observed among (ProTaper) and the two of (Wave-One) and (One-Shape) and (p=0.005) respectively. No significant unlikeness was found among (Wave-One) and (One-Shape) where (p=0.186). The greatest mean value was observed in (ProTaper) (432.11 ± 63.42) followed by (One-Shape) (334.61 ± 63.02), while the least mean value was found in (Wave-One) (283.91 ± 61.53). (Fig.2)

Group II (Resin):

With solvent: it was found that there was a significant unlikeness among (ProTaper), (Wave-One) and (One-Shape). A significant difference was observed among (ProTaper) and the two of (Wave-One) and (One-Shape). No significant unlikness was found among (Wave-One) and (One-Shape). The greatest mean value was observed in (ProTaper) (436.94 ± 51.17) followed by (One-Shape) (327.54 ± 45.42), while the least mean value was found in (Wave-One) (277.54 ± 52.22).

Without solvent: There was a significant unlikeness among (ProTaper), (Wave-One) and (One-Shape). A significant unlikeness was found among (ProTaper)and the two of (Wave-One) and (One-Shape) where (p<0.001) and (p=0.009) respectively. No significant unlikness was found among (Wave-One) and (One-Shape). The greatest mean value was observed in (ProTaper) (330.21 ± 66.08) followed by (One-Shape) (233.81 ± 67.55), while the least mean value was found in (Wave-One) (172.81 ± 66.02). (Fig.2)

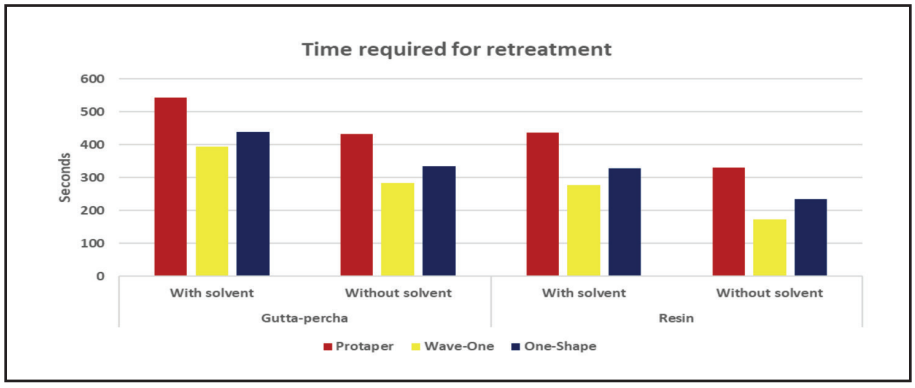

Figure (2): Bar chart representing the effect of files type and obturation material on time needed for refilling of root canals.

DISCUSSION

It was observed in the results that ProTaper retreatment set was very effective than waveone file in filling material removal during retreatment although there's no significant difference between them. However, there's significant difference between them and the Oneshape file. ProTaper Universal retreatment System performs better in removing filling material than waveone and OneShape files because it was composed of three files with different taper and diameter, D1 has active tip that permit initial penetration through the obturating material, fracture is difficult because of the constant taper of each file [13], this was supported by many researches[5,12]. they attributed it to the three different length and taper design of the files, their design permit the instruments to go through gutta-percha and the dentine outer layer during retreatment. The results were supported by a previous study which found that ProTaper retreatment set was effective as Wave One in wiping out the obturation material [17].

The result of the present study showed One shipshape was significantly ineffective in wiping out the obturation material from the canals. This examination was supported by previous studies [6,7,8,15]. However, there is insufficient experimental documentation to correlate the use of Wave One files and ProTaper set used in retreatment to One Shape file in terms of the remaining remnants.

Also, it was found that EndoREZ has the least amount of residual obturation material than guttapercha, and this was observed in all the systems used. This is explained by the strong adhesion between EndoREZ sealer and the resin coated guttapercha. EndoREZ sealer is easier in removing as it becomes one unit with the material of the core. However, it is difficult to coat the entire canal with the EndoREZ sealer; therefor, the bond between EndoREZ and dentin is inadequate. EndoREZ has weak resin-dentin adhesion which may help in removing the resin from inside the canals. There are many reasons that affect the adhesion between dentin and resin, such as inefficient using of EDTA in deep parts, using of NaOcl as an irrigant that may affect the bond strength, and the existence of uninstrumented parts. These results are in accordance with previous studies [4,9], which expressed that when using Resilon, the canals were cleaner compared to gutta-perch, and this is in contrast with many authors [13,16].

In regard to using of solvents, upon using ProTaper Universal set, waveone, and OneShape files and the use of chloroform increase the amount of remnants. These results are in supported by many authors [1,14] they concluded that using of solvents and the softening effect of solvents will produce more debris as a thin film on the canal walls [2]. However, these results are contradicted by others who conversely, found that retreatment without solvent decrease the working time [13].

The time required to reach the working length in the current study was significantly faster when using the Wave One file and Oneshape file than the Pro- Taper files. This is due to the single file concept in waveone and one shape files. In the current study additional use of chloroform with all system proved to increase the working time of removal of gutta-percha and EndoREZ, these results were supported by many authors who found that retreatment without solvent decrease the working time [13]. However, other studies on different rotary systems found that additional use of solvents decrease the working time [2,3,11], and this may be because the gutta-percha when it becomes soft it will be smoother to be removed and less resistant.

Also, in the current study it was found that removal of EndoREZ was faster than gutta-percha due to that the core material of the resin based obturation materials very low melting point than gutta-percha and high molecular weight; as a result, heat exerted by rotary instruments the resin based obturation materials was found to be more flowable than does gutta-percha [4,5,10]

CONCLUSION

1. None of the tested retreatment systems can remove the root canal obturation material completely especially at the apical third.
2. The ProTaper retreatment rotary instruments and Wave One file remove more obturation material when it compared to OneShape file.
3. The single file concept proved to be quick way for clearing away all the obturation materials in retreatment cases.
4. Regardless of systems which used in retreatment, the amount of residual gutta percha filling material was greater than with EndoREZ.
5. Retreatment without the use of solvent was less time consuming and more effective than with solvent.
6. The percentage of fractured files was greater in Waveone one file than OneShape file, no broken files in ProTaper retreatment system was encountered during retreatment.

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