Evaluation of different techniques used in non surgical endodontic retreatment for teeth with different obturation techniques (An in-vitro study)

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ABSTRACT

Background: Retreatment procedures in endodontic practice require complete removal of the original root filling materials. The aim of this study was to evaluate the efficacy & time required for rotary Nickel titanium NiTi instruments (Pro-Taper) with and without solvent in the removal of obturation materials during root canal retreatment in comparison with hand instruments using Hedstrom files with solvent in relation to different obturation techniques.

Materials and method: Ninety extracted human roots were instrumented by ProTaper rotary files to (F3) ISO # 30 and the samples were randomly divided into three groups of 30 roots for each group A: obturated by cold lateral condensation technique, group B: obturated by Injectable thermoplasticized technique, group C: obturated by carrier based gutta-percha technique (Soft Core) obturator. Each main group of roots was randomly subdivided into three subgroups, 10 roots each. Removal of gutta-percha was performed the following techniques; (1) Pro-Taper without solvent, (2) Pro-Taper with solvent and (3) Hedstrom files with solvent. The roots were split longitudinally. The area of remaining filling was evaluated by using stereomicroscope at three levels in the canal and time of retreatment was determined in each group.

Results: One-way ANOVA test indicated that the rotary NiTi instruments Pro-Taper with and without solvent left significantly less remaining filling materials ($P < 0.001$) compared to Hedstrom files with solvent while there was no significant difference at ($p<0.05$), between Pro-Taper with solvent and without solvent. In groups obturated by cold lateral condensation and injectable thermoplasticized techniques left significantly less remaining filling materials at ($p<0.05$), than group obturated by soft core obturators. The retreatment time was significantly less at ($P < 0.001$) when the rotary NiTi Pro-Taper instrument was used compared to hand.

Conclusion: ProTaper rotary instrument with and without solvent was found to be effective and faster than hand instruments and Cold lateral condensation technique and inject able thermo plasticized technique better removed in retreatment than Soft Core obturator technique.

Keywords: retreatment; rotary instruments; residue material; obturation techniques. (J Bagh Coll Dentistry 2012; 24(sp. Issue 1):31-35).

INTRODUCTION

Gutta-percha has been used in endodontic therapy for more than 100 years and is still the principal material for filling root canals. Thus, endodontic retreatment fundamentally consists of the removal of gutta-percha cones from inside root canals [(1)].

Gutta-percha, in combination with sealer cements can be removed with several techniques such as solvents, K-type or Hedstrom files, Gates Glidden drills, heated pluggers, ultrasonic technique and lasers (Nd:YAP laser) [(2)] .

Currently, nickel titanium rotary instruments (NiTi) like Reamer with alternate Cutting edges (RaCe), Pro-Taper, K3 and Greater Taper (GT) rotary have an important role in the removal of gutta-percha for their ability to simulate curved canals & effectively produce well tapered root canal form requiring less time**,** although complete removal of gutta-percha has not been attained with these instrument, Also Care must be taken to avoid fracturing these rotary instruments inside the canal, thus further complicating the retreatment [(3)].

A solvent can facilitate the removal of gutta-percha by softening it. Among the organic solvents more frequently used in endodontic retreatment are: chloroform, xylol, halothane, eucalyptol, orange oil, and rectified turpentine [(4)].

The purpose of the present study was to evaluate the efficiency of NiTi rotary instruments (Pro-Taper) with & without solvent compared with manual Hedstrom files with solvent for removal of gutta-percha from root canal during endodontic retreatment in relation to different obturation techniques. Also to calculate time needed for different retreatment techniques in relation to different obturation techniques.

MATERIALS AND METHODS

Sample selection and preparation: Ninety extracted single-rooted human teeth with a single straight root canal (less than 30 º curvatures), were selected and stored in a special container containing 50% alcohol solution until use. The collected teeth had been subjected to de-coronation process using a slow speed conventional hand-piece with diamond cutting disc with water coolant for disking. Working length was standardizing to 12 mm and apical patency was confirmed with a size 15 K-file.

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Instrumentation: coronal 3mm was flared with Gates Glidden drills 1, 2 and 3 in a telescopic preparation. The apical thirds were prepared by the crown down technique using ProTaper rotary system by Dentsply engine at 300 rpm with torque number 3to F3 files (finishing files) and 4% of chlorhexidin solution used for lubricating canal and instrument. The teeth were then dried and divided into three groups. Group A: Thirty roots obturated with gutta-percha cone using cold lateral compaction technique. Group B: Thirty roots were obturated with injecting thermo-plasticized gutta-percha mass using Bee-fill device. Group C: Thirty roots were obturated with Soft-Core thermo plasticized obturators. After obturation, the samples were radiographed in both bucco- lingual and mesio-distal aspects to evaluate the homogeneity, compaction, adaptation & extension of the obturation at 2- dimension view in which one film was used to take radiograph for one tooth Then the roots were wrapped in saline moistened gauze in closed glass tubs allowing the sealer to set for one month with 100% humidity at 37ºC for aging [5].

Re-treatment Techniques: At the end of the one month, 3 mm of obturation material was removed from the coronal part of the root canal of all roots using Gates Glidden drills 2 and 3. Sodium hypochlorite 5% irrigation was used after each instrument (1ml for each root). Then each group including (30 samples) has been subdivided for retreatment as follow:

Subgroup 1 (n=10): using ProTaper NiTi rotary instruments without solvent**:** Rotary instruments were driven with a torque-controlled motor according to the manufacturer's instructions 300 rpm (round per minutes), the gutta-percha was removed by the following sequence using light apical pressure: Finishing files F3= (ISO size 30, taper O.O9-O.O5), F2= (ISO size 25, taper 0.08-0.055), and F1= (ISO size 20, taper O.O7-O.O55) was used in a crown-down technique to remove the gutta-percha until the working length was reached. Finishing files F2 and F3 was used again to the working length to complete gutta-percha removal and cleaning of the canal walls.

Subgroup 2 (n=10): using ProTaper NiTi rotary instruments with solvent: three drop of Xylol solvent was introduced into each canal for 2minute to soften the gutta-percha. Two additional drop of solvent was applied as required to reach the working length for 2 minute then Rotary instruments was driven with a torque-controlled motor according to the manufacturer's instructions 300 rpm (round per minute) , then the gutta-percha was removed as sub group 1.

Subgroup 3 (n=10): retreatment using Hedstrom files (Manual) and solvent: three drop of Xylol solvent was introduced into each canal for 2 minute to soften the gutta-percha. Two additional drop of solvent were applied as required to reach the working length for 2 minute. Then, ISO size 15 and 20 Hedstrom files were used for deep penetration until they reach the working length and after that removal of gutta-percha was completed using size 25 - 30 Hedstrom files in a circumferential quarter-turn push-pull filing motion (to engage the GP). After removing the filling material, the roots were marked at the middle of mesial and distal sides with longitudinal line by a permanent marker. Then the roots were cut into 2 halves buccal and lingual using a diamond cutting disc via slow-speed conventional hand-piece with water cooling, and the roots were split with aid of chisel for evaluation in thirds.

Cleanliness wall was scored with the aid of a stereomicroscope which was adopted for the evaluation of residual gutta-percha and sealer on the canal Walls, as it was considered a simple and efficient assessment method.

Both halves of each split tooth were divided into coronal, middle, and apical thirds, measuring from the cemento-enamel junction to the terminus of the apical preparation, using a permanent pencil. The evaluation scales was used as follow :

Score 1**:** None to slight remaining (<25%) obturating material and debris on the dentin surface (fig. 1).

Scores 2: Some remaining (25-50%) obturating material and debris on the dentin surface (fig. 2).

Scores 3: Moderate remaining (50-75%) obturating material and debris on the dentin surface (fig. 3).

Scores 4: Heavy remaining (>75%) obturating material and debris on the dentin surface (fig. 4).

The data were collected and analyzed using ANOVA-test. P value of =<0.05 was regarded as statistically significant.

RESULTS

1. Stereomicroscopic evaluation

By using ANOVA test, generally there was a significant difference between HSF/Solvent retreatment techniques compared with RNT-PT with & without Solvent in three obturation techniques at p<=0.05. While, there was no significant difference between the HSF\Solvent retreatment technique in three obturation techniques at p<=0.05 By using ANOVA-test there was significant difference between the SC obturation techniques in compared with CLC & ITT obturation techniques at p< o.o5, While there was no significant difference between CLC & ITT

obturation techniques during endodontic retreatment(table 1), (fig. 5). By using ANOVA-test, generally, there was highly significant difference between the HSF\Solvent in compared with RNT-PT with & without Solvent in retreatment at P< 0.001. While, there was no significant difference between uses of RNT-PT, with & without solvent in removing obturation materials during endodontic retreatment at p>0.05(table 2) (fig. 5). By using ANOVA- test, generally, there was significant difference between apical & coronal third in amount of remaining obturation materials in each techniques at p<o.o5. While, there was no significant difference between middle in compared with apical & coronal in amount of remaining obturation materials in each techniques during endodontic retreatment at p>0.05. By using ANOVA- test, generally, there was highly significant difference between the retreatment techniques at P=<0.001. i.e., highly significant difference between times required for uses of RNT-PT, RNT-PT\Solvent compared to HSF\solvent techniques in removing obturation materials during endodontic retreatment (table 3), (fig. 7).

DISCUSSION

The main goal of retreatment is to regain access to the constriction by complete removal of the root canal filling material, thereby facilitating sufficient cleaning and shaping of the root canal system and final obturation.

In the present study root canal preparation was done by one operator following predetermined protocol using Rotary NiTi Pro-Taper and the canals were instrumented to a size F3= Iso size #30 as master apical file**,** as did by [5] [7].

Although cold lateral condensation is one of the most accepted canal obturation techniques, the gutta-percha does not adapt to the canal walls especially in irregular canals, Injected thermo plasticized gutta-percha can adapt more effectively to irregularities in the canal, thus replicating the root canal system, also carrier based gutta-percha technique showed good adaptation to the canal walls and all parts of the canal regardless of the presence or absence of a smear layer [8]. This fact may affect the retreatment techniques, since the obturation material that inters the canal irregularity may not be so easy in removing sufficient amount during re treatment.

In this study there was significant difference between cold lateral compaction technique & inject able thermo-plasticized technique compared to soft core obturator technique at (p<0.05), in remaining of root canal filling materials after retreatment techniques. These results may be due to: First: the presence of the core materials which make the removal of GP harder & difficult. Second: better seal ability of soft core obturator to the canal walls than other techniques so during retreatment exert some difficulty in removing titer seal gutta-percha from canal walls [9].

the findings of the present investigation showed that the rotary NiTi ProTaper instruments are with & without solvent highly significantly more effective in removing gutta-percha from the whole root canals compared to hand instruments at (p<0.001), these results consistent with the previous studies [7] [10]. All the retreatment techniques left less remaining filling materials in the coronal third followed by the middle third & the apical third showed the highest ratio of remaining filling materials. These findings were similar to several studies [11] [12]. This may be due to increased anatomical variability and difficulty of instrumentation and retreatment in this region.

Different solvents have been used for GP removal, like xylene, chloroform, eucalyptol, rectified turpentine oil & white pine oil. Although xylene and chloroform are excellent solvents of GP, but chloroform proved to be toxic and carcinogenic [13]. Finding of the studies revealed that there was not significant different between the use of Pro Taper with solvent & Pro Taper without solvent, since the using Pro Taper without solvent also more effective in cleaning canal walls. This result consistent with the previous study performed by some authors [14] [15]. The better performance of proTaper retreatment files may be due to, their flute design which pulls GP out and directs it to the orifice, Also the frictional heat plasticizes GP and allows its easy removal [13].

In the present investigation, the time recorded for retreatment techniques was significantly less when using the Pro-Taper rotary NiTi instruments with & without solvent when compared to the hand instruments (Hedstrom files) with solvent. These results were in accordance with previous reported studies [5] [16] [17].

CONCLUSIONS

ProTaper rotary instrument with and without solvent was found to be effective and faster than hand instruments. Cold lateral condensation technique and inject able thermo plasticized technique better removed in retreatment than Soft Core obturator technique.

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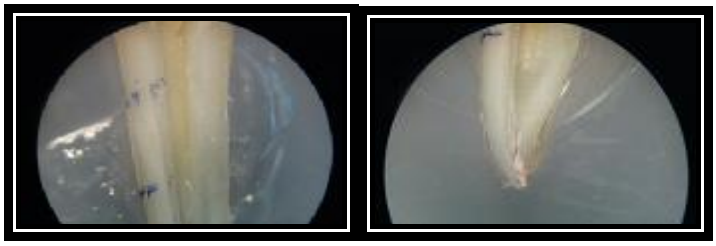

Figure 1: Score 1 **Figure 2: Score 2**

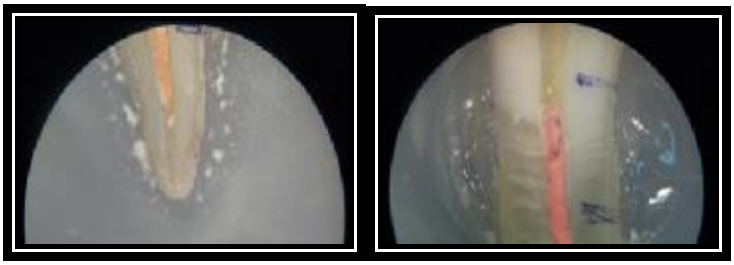

Figure 3: Score 3 **Figure 4: Score 4**

Table 1: The Descriptive statistic & ANOVA-test of the obturation techniques in endodontic retreatment Stereomicroscopic evaluation)

Group	ANOVA-test	P value Sig	Test Bonferroni
1 CLC	4.617	0.012 S	3×1 3×2
2 ITT			
3 SC			

Table2: The descriptive statistic & ANOVA for the three retreatment techniques (Stereomicroscopic evaluation).

Groups	ANOVA-test	p-Value Sig	(Bonferroni)
RNT-PT	15.03	0 HS	3×1 3×2
RNT-PT\S			
3 HSF\S			

Table 3: The Descriptive statistics, ANOVA & Bonferroni test for time of the retreatment of the nine groups.

Obturation techniques	Retreatment techniques	ANOVA P value	(Bonferroni)
1 CLC	1 RNT-PT	43.293 0.001 HS	1×3 1×6 1×9 2×3 2×6 2×9 4×3 4×6 4×9 5×3 5×6 5×9 7×3 7×6 7×9 8×3 8×6 8×9
	2 RNT-PT\Solvent		
	3 HSF\Solvent		
2 ITT	4 RNT-PT		
	5 RNT-PT\Solvent		
	6 HSF\Solvent		
3 SC	7 RNT-PT		
	8 RNT-PT\Solvent		
	9 HSF\Solvent		

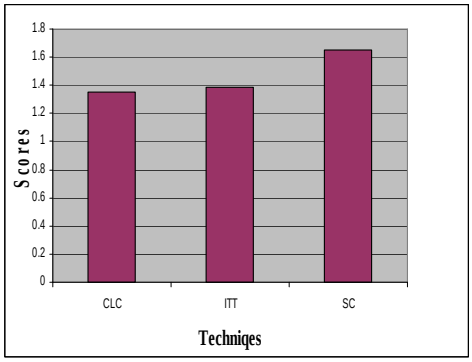

Fig. 5: Bar chart showing the obturation techniques in endodontic retreatment (stereomicroscopic evaluation)

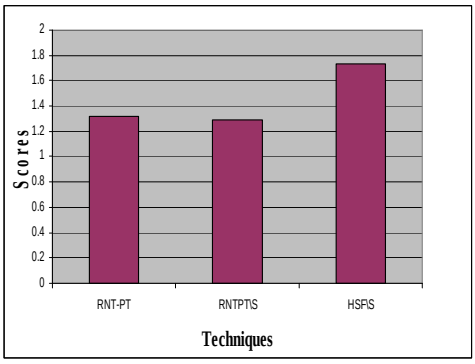

Fig. 6: Bar chart showing the retreatment techniques used in endodontic retreatment, (Stereomicroscopic evaluation).