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RESEARCH ARTICLE

COMPARISON OF THE RETREATMENT FILES IN THE REMOVAL OF GUTTA PERCHA AND THE EVALUATION OF THE DEFECTS IN THE CANAL WALLS

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ABSTRACT

Objectives: To evaluate and compare the defects produced on root canal walls during the use of H-files, Pro Taper retreatment files and M-two retreatment files in removal of gutta-percha and also to evaluate the time required for complete removal of gutta-percha.
Method: Root canals of 60 single-rooted mandibular premolars were cleaned, shaped, and obturated with gutta-percha and AH plus sealer. The teeth were then randomly divided into four main groups. The group where retreatment was not carried out served as the control group. Gutta-percha was removed in the other three groups using either H-files, ProTaper retreatment files or M-two retreatment files. The roots were sectioned horizontally at 3, 6, and 9mm from the apex with a diamond disc. The root slices were viewed under a stereomicroscope for presence of cracks. Total time required for complete removal of gutta-percha was recorded for each sample.
Results: Cracks were observed in all the groups. Total number of cracks present in ProTaper retreatment group, M-two retreatment group, H-files and control group was 44.4%, 35.6%, 13.3% and 4.4% respectively. H-files took significantly more time for removal of gutta-percha when compared with rotary files.
Conclusion: Use of rotary Ni-Ti retreatment files leads to increased chances for dentinal defects and cracks. ProTaper retreatment files, though faster than M-two retreatment files or H-files, produced the most number of defects and cracks in the canal walls.

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INTRODUCTION

Endodontic therapy has been in a progressive pace in the recent times. Significant advancements in cleaning, shaping and obturation techniques have taken place rapidly (Smith, 1993). However, even with the high degree of success rate, clinicians are still confronted with endodontic failures, requiring the challenge for retreatment (Cohen, 2012 and Hulsmann, 2004). The treatment options for endodontic retreatment include non-surgical retreatment, apicoectomy or extraction. Non-surgical retreatment is is most commonly the treatment of choice as it is a conservative method (Cohen, 2012; Uezu, 2010; Weller, 2005). Non-surgical retreatment requires the complete removal of obturating material thereby facilitating total disinfection of the root canal system thereby restoring healthy periapical tissue and allowing tissue repair. Thus the removal of the root filling must enable for effective cleaning, shaping and obturation of the root canal system (Steven, 2005; Bier, 2009). A plethora of techniques are employed for the removal of gutta-percha which includes endodontic hand instruments and Ni-Ti rotary systems with or without solvents, ultrasonics, lasers and heat carrying instruments (Hulsmann, 2004; Uezu, 2010). Stainless steel hand H files and K files have been routinely used for gross removal of gutta-percha from root canals. However, they are time consuming and may cause straightening of the canal.Ni-Ti retreatment files have progressive tapers and a larger metallic core which enables them to cut not only gutta-percha but also superficial layers of dentin which may lead to complications such as reduction in remaining dentin thickness and formation of craze lines and cracks on the root canal walls (Smith, 1993). These cracks may lead to root fracture and treatment failure (Bier, 2009; Takahashi, 2009).

Primary endodontic treatment using NiTi rotary files have been shown to produce defects on the root canal walls. The additional mechanical manipulation and preparation during retreatment may further damage and weaken the canal walls (Shemesh, 2011). Thus, the aim of this study was to evaluate and compare the defects produced on root canal walls during the use of H-files, ProTaper retreatment files and M-two retreatment files in the removal of gutta-percha and also to evaluate the time required for complete removal of gutta-percha.

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MATERIALS AND METHODS

Sample selection

Sixty freshly extracted human single rooted mandibular premolars extracted for periodontal or orthodontic reasons were used in the study. Teeth with cervical abrasion, cracks, root resorption, root caries, open apices, curved roots, calcified canals or aberrant canal morphology were excluded from the study.

Teeth preparation

The crown of each tooth was sectioned perpendicular to the long axis of the root to standardize the root length to 16 mm, using a diamond disc (Horico, Germany). Working length was determined by inserting a #10 K-file (Mani. Inc Japan) until it just exited the apical foramen. 1 mm was subtracted from this length to obtain the final working length.

Canal preparation and obturation technique

The canals were shaped using the full sequence of ProTaper rotary instruments at 300 rpm (files Sx, S1, S2, F1, F2, F3, F4) in the presence of chelating agent (RC Prep). Root canals were irrigated with 2ml of 3% sodium hypochlorite between each instrument change. After biomechanical preparation was completed, canals were irrigated with 2 ml of distilled water. All roots were kept moist throughout the experimental procedure. Obturation of root canal was carried out using lateral compaction technique. A #40, 2% gutta-percha point was used as the master cone. Root canals were dried with size 40 paper points. AH plus sealer was mixed according to manufacturer's instructions and introduced into the root canal using lentulo spiral.

The master cone was coated with sealer and slowly introduced into the root canal. Lateral condensation was performed using finger spreaders and additional accessory gutta-percha points were introduced into the root canal. Following removal of gutta-percha using a hot burnisher, the remaining material was vertically condensed. The teeth were then stored in 100% relative humidity at 37^{o}C for 3 weeks to ensure complete polymerization of the root canal sealer. Then teeth were randomly divided into four main groups, comprising of fifteen teeth each (n=15). Gutta-percha was not removed in one group which served as control. Removal of gutta-percha was carried out in other three groups using H-files, ProTaper retreatment file and M-two retreatment file.

Removal of gutta-percha

Group 1 (Control): In this group, gutta-percha was not removed after obturation and served as control.

Group 2: In this group, gutta-percha was removed using H-files. 3 mm of the gutta-percha at the entrance of the root canal was removed using Gates Glidden drills. A drop of chloroform was placed into the root canal to soften the gutta-percha and H-files were used in push and pull motion. Sizes 35, 30, 25 H-files were used in a sequential manner. Two to three additional drops of chloroform were introduced into the canal as required to ensure complete removal of obturating material and to reach the full working length.

Group 3: In this group, gutta-percha was removed using Pro Taper retreatment files. These files were introduced into the canal in sequential manner (D1, D2, and D3). D1 (#30 with 9% taper) was used in the coronal third of the root canal, D2 (#25 with 8% taper) was used in the middle third of the root canal and D3 (#20 with 7% taper) was used in the apical third of the root canal.

Group 4: In this group, gutta-percha was removed using M-two retreatment files. These files were used sequentially (R15 and R25). R25 (#25 with 5% taper) was used in the coronal third of the root canal and R15 (#15 with 5% taper) was used in the middle and apical third of the root canal.

Evaluation of removal of gutta-percha

The roots were considered clean when no remnants of gutta-percha were observed in the flutes of the instrument or in the irrigating solution collected on the cotton. Total time required for complete removal of gutta-percha was recorded for each sample.

Examination of the roots

The roots were sectioned horizontally at 3, 6, and 9 mm from the apex with a diamond disc. The root slices were viewed under a stereomicroscope at 15X magnification and photomicrographs were taken with a digital camera. It was evaluated separately by two observers for presence or absence of cracks on root canal walls. Two distinct categories were made: ''no defect'' and ''defect''.

Statistical Analysis

Descriptive and inferential statistical analysis was carried out in the present study. Analysis of variance (ANOVA) was used to find the significance of study parameters between the groups and Chi-square/ Fisher's exact test has been used to find the significance of study parameters on categorical scale between the groups.

RESULTS

Cracks were observed in all the groups evaluated. In the ProTaper retreatment group cracks were observed in 40% of samples in the apical third of root canal, 53.3% in the middle third and 40% at coronal third. In the M-two retreatment group cracks were observed in 33.3% of samples in the apical third of root canal, 40% in the middle third and 33.3% at coronal third. With H-file cracks were observed only in 13.3% of the samples in the apical, middle and coronal thirds. In the control group cracks were observed in 6.7% of samples in apical third of root canal, 0.0% in middle third and 6.7% at coronal third. Total number of cracks present in ProTaper retreatment group, M-two retreatment group, H-files and control group was 44.4%, 35.6%, 13.3% and 4.4% respectively (Table 1).

Time taken for complete removal of gutta-percha was measured by Post–Hoc Tukey test. Average time taken for removal of gutta-percha by ProTaper retreatment files was 1.88 minutes, M-two retreatment files was 5.75 minutes and H-files was 11.91 minutes (Table 2).

Table 1. Incidence of cracks after retreatment procedures in four groups

Group	Section			Total	P value
	Apical (n=15)	Middle (n=15)	Coronal (n=15)		
ProTaper retreatment files (n = 45)	6	8	6	20	0.698
M-two retreatment files (n = 45)	5	6	5	16	0.908
H-files (n = 45)	2	2	2	6	1.000
Control (n = 45)	1	0	1	2	0.593

Table 2. Average time taken for removal of gutta-percha in four groups

Time taken (in minutes)	ProTaper	M-Two	H Files	Control	Total
0	0	0	0	15	15
1-5	15	3	0	0	18
5-10	0	12	0	0	12
10-15	0	0	15	0	15
Total	15	15	15	15	60
Mean ± SD	1.89±0.39	5.76±0.77	11.91±0.68	0.00±0.00	4.89±4.62

DISCUSSION

Retreatment files usually faciliatate gutta percha removal in a shorter time. This rapidity owes to its unique design of having a greater taper and larger metallic core that generates heat for removal. However, in the process of gutta-percha removal, it may lead to complications such as reduction in remaining dentin thickness and formation of craze lines and cracks on the root canal walls. During function, these cracks may propagate from the root canal to the external surface of the root and cause root fracture and further treatment failure (Bier, 2009; Takahashi, 2009l Shemesh, 2011). The highest number of cracks after retreatment was seen in the ProTaper retreatment group, followed by M-two retreatment group and the least was seen in the H-file group. In the apical third of the root canal, ProTaper retreatment group showed more cracks when compared with M-two retreatment group, H-file group and control group. However, the difference was not statistically significant. In the middle third of the root canal, ProTaper retreatment group showed more cracks when compared with M-two retreatment group, H-file group and control group. There was no statistically significant difference when ProTaper retreatment group was compared with M-two retreatment group and H-file group. However, this difference was statistically significant when compared with the control group. In coronal third of the root canal, ProTaper retreatment group showed more cracks when compared with M-two retreatment group, H-files group and control group. However, the difference was not statistically significant. Among all groups, ProTaper retreatment files showed maximum number of cracks after retreatment. This could be due to the progressive taper and length of the retreatment files which enable them to cut not only gutta-percha but also superficial layers of dentin during removal of gutta-percha. The findings of our study were in accordance with Moraes et al who reported that ProTaper retreatment files and M-two retreatment files caused the greatest and lowest temperature increase on root surface and ProTaper retreatment files needed less time to remove gutta-percha than M-two retreatment files (Bramante, 2010). M-two retreatment files showed more number of cracks when compared with H-files and less number of cracks when compared with ProTaper retreatment files. This may be due to the fact that M-two retreatment files have a smaller core diameter and lesser taper when compared with ProTaper retreatment files and a greater taper when compared with H-files. Manual instrumentation with H-files tend to remove gutta-percha in chunks and pieces. Also, the lesser taper of these instruments could be a contributing factor for decreased cracks (Shemesh, 2011). H-files took significantly more time for removal of gutta-percha when compared with ProTaper retreatment files and M-two retreatment files. M-two retreatment files took significantly more time for removal of gutta-percha when compared with ProTaper retreatment files. Our findings were in accordance with those of Gu et al and Moraes et al (Bramante, 2010). The reason for ProTaper taking least amount of time for removal of gutta-percha may be directed to the fact that the cutting tip of the D1 instrument allows more efficient initial penetration into the gutta-percha and also the greater taper and larger metallic core facilitating rapid removal of gutta-percha (Bramante, 2010).

Conclusion

Thus within the limitation of this study, it was concluded that hand instruments like H-file, though slow are the safest, producing the least number of cracks and defects in the canal walls. Use of rotary Ni-Ti retreatment files lead to an increased chances for dentinal defects and cracks. ProTaper retreatment files, though faster than M-two retreatment files or H-files, produced the most number of defects and cracks in the canal walls.

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