AN IN-VITRO ESTIMATION OF APICAL EXTRUSION OF DEBRIS BY INSTRUMENTATION WITH THREE COMMERCIALLY AVAILABLE FILE SYSTEMS: AN ORIGINAL RESEARCH STUDY

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Abstract

Aim: The present study was conducted to evaluate apical extrusion of debris by instrumentation with three commercially available rotary file systems.

Materials & Methods: Forty eight freshly extracted maxillary lateral incisors were collected by systematic sampling procedure. All samples were sectioned to make access opening. The teeth were studied into three study groups with sixteen teeth each. Bio mechanical preparations were finished by three different commercially available rotary file systems (One Shape Rotary File System- group I, Neoendo Flex Files- group II, Waldent Wal-flex Gold Rotary Files- group III). Debris collection was done glass vial. The exact weight of the collected debris was calculated by subtracting the weight of the empty vials from the weight of the vials containing debris. P value less than 0.05 was considered significant.

Statistical Analysis & Results: Statistical analysis was performed using statistical software 'Statistical Package for the Social Sciences (SPSS)' version 22. Mean debris extrusion by One Shape Rotary Files was 0.181 milligrams. Neoendo Flex Rotary Files showed 0.238 milligrams of mean extruded debris while Waldent Wal-flex Gold Rotary Files showed 0.292 milligrams of mean extruded debris. Level of Significance (p value) was significant for group III. The p value was very significant for ANOVA conducted between groups (0.001).

Conclusion: In all the three tested systems, Waldent wal-flex gold rotary files confirmed maximum amount of debris extrusion. Minimum amount of debris was extruded by One shape rotary files. Hence, One shape rotary systems must be suggested for challenging cases.

Key Words: One Shape Rotary Files, Neoendo Flex Rotary Files, Waldent Wal-flex Gold Rotary Files, Debris, Nickel–Titanium.

Introduction

NiTi systems and associated armamentarium have literally revolutionized the entire practice of endodontics. With the inception of this system, the clinical chair time has significantly reduced with evident precision. This NiTi system has several over and above benefits compared to the traditional filing systems.[1,2] Many of the mechanical properties are very user friendly and long lasting in NiTi systems however these properties were highly cumbersome in old file systems. With the improvement of mechanical strength and other properties, now there are apparently lesser chances of file breakage with NiTi systems. Since file breakage was one of the biggest fears during endodontic instrumentation, such innovations have taken place.[3,4] Manufacturers have experimented several design modifications in the rotary NiTi systems to make them most precise and handy. Like many of the NiTi systems producers use heat treatment for hardening and associated flexibility. Manufacturers also ensured about complete flute opening during the usage. Other properties like shape memory and related phenomenon have also been adopted by few manufacturers to improve overall performances. Biomechanical preparation is an significant event during endodontic therapy.[5,6] This mandatorily involves pushing action of thin files irrespective of their mode of action. All such procedures are actually increasing the chances of debris pushing in to peri-apical areas. This is an unwanted event and must be minimized of vanished in order to prevent re-infection of peri-radicular tissues. However these clinical issues were most evident in older and traditional filing systems compared to advanced NiTi systems. Therefore, considering all these significant points the present study was conducted to estimate apical extrusion of debris by instrumentation with three commercially available rotary file systems.

Materials & Methods

The present study was initiated, intended and performed in the department of Conservative Dentistry and Endodontics of the college. Total forty eight freshly extracted maxillary lateral incisors were used in the study as samples. The fundamental reason of tooth extraction was their high mobility due to interior periodontal problems. Specimens were finalized by systemic sampling procedure. All samples were cleaned methodically to remove all hard and soft deposits. Exclusion criterion included teeth with caries, developmental defects, severely curved root, root canal treaded teeth. All sample teeth were mounted into square blocks of dental stone. For initiating the study methodology, all samples were sectioned at suitable incisal levels to create standard access opening. Firstly, working length was determined by fifteen no K-file. Care was taken to restrict it one mm short of the real length near the major diameter of the apical foramen. Predictable root canal shaping and enlargement (bio mechanical preparations) was completed by three different commercially available rotary file systems. These were One Shape (One Shape Rotary File System, Micro-Mega Inc. France), Neoendo Flex Files (Neoendo Flex Rotary File

Systems, Orikam Inc. Mumbai, India), Waldent Wal-flex Gold Rotary Files (Waldent Innovations Pvt Ltd, New Delhi, India). Authors intended to collect and quantify any debris pushed out of root canal. The teeth were divided into 3 study groups with 16 teeth present in each experimental group. The samples in each group were prepared by using different rotary file systems. One shape rotary files, Neoendo flex rotary files and Waldent wal-flex gold rotary files were studied in group I, II and III respectively. Debris collection was completed in 3 ml glass vial (Northern Scientific Emporium, New Delhi, India). Debris that had attached to apical foramen area was included. The dried out weight of the pushed out debris was estimated after two week incubation (in incubator) at 38°C. Incubation allows evaporation of the residual irrigant from the vials. The accurate weight of the collected debris was calculated by subtracting the weight of the empty vials from the weight of the vials containing debris. Results were sent to statistical analysis. P value less than 0.05 was considered significant.

Statistical Analysis and Results

All relevant data were sent for statistical analysis using statistical software Statistical Package for the Social Sciences version 22.0. The screened data was subjected to suitable statistical tests to obtain p values, mean, standard deviation, chi- square test, standard error and 95% CI. Initial outcomes of the results were very crucial. Table I demonstrates three different types of commercially available rotary files systems. They were segregated as group 1, 2, 3 of 16 (samples) each. Table 2 basic statistical descriptions showing mean, std. deviation, std. error, 95% coefficient of interval, Pearson Chi-Square Value and Level of Significance (p value). Mean debris extrusion by One Shape Rotary Files was 0.181 milligrams. Neoendo Flex Rotary Files showed 0.238 milligrams of mean extruded debris while Waldent Wal-flex Gold Rotary Files showed 0.292 milligrams of mean extruded debris. The calculated standard deviation for group I, II and III 0.039, 0.324, 0.535 respectively. Measured standard error for group I, II and III was 0.003, 0.324, 0.735 respectively. Pearson Chi-Square Value for group I, II and III was 1.837, 1.962, 1.312 respectively. Level of Significance (p value) for group I, II and III was 0.50, 0.40 and 0.01 respectively. It was significant for group III. Graph 1 shows mean volume of extruded debris (milligrams), standard error and standard Deviation in all three studied groups. Table 3 shows comparison among the 3 study groups using ONE-WAY ANOVA. The calculated Level of Significance (p value) was highly significant for ANOVA conducted between groups (0.001). Degree of freedom for between group, within group and cumulative was 2, 16, 68.02 respectively. Sum of squares for between group, within group and cumulative was 1.941, 3.526, 7.029 respectively. Cumulative Mean Sum of Squares was 1.039 and 0.526 for between group, within group respectively.

Table 1: Distribution of sample teeth according to systems and groups

Groups	**Group I**	**Group II**	**Group III**
System	One Shape	Neoendo	Waldent
Number	16	16	16

Table 2: Basic statistical descriptions showing mean, standard deviation, standard error, 95% coefficient of interval, Pearson Chi-Square Value and Level of Significance (p value)

Groups	Mean (milligrams)	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
I	0.181	0.039	0.003	1.02	1.837	1.0	0.50
II	0.238	0.324	0.324	1.41	1.962	2.0	0.40
III	0.292	0.535	0.735	1.73	1.312	1.0	0.01*

Graph 1: Mean of extruded debris (milligrams), standard deviation and standard error in all three studied groups

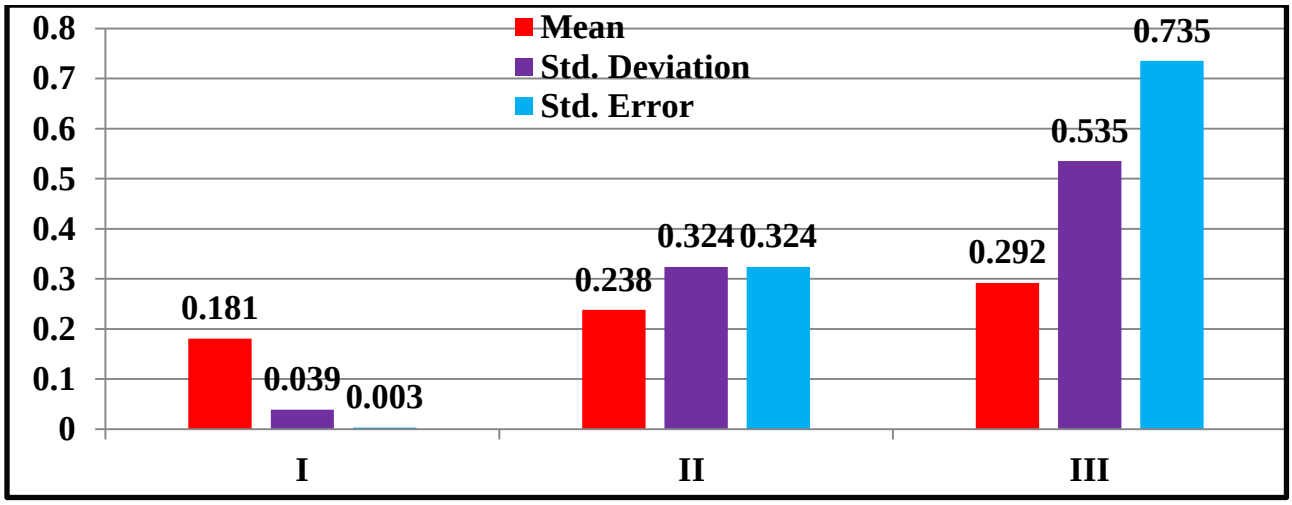

Table 3: Comparison among the 3 study groups using ONE-WAY ANOVA [for group I, II, III]

Variables	Degree of Freedom	Sum of Squares ∑	Mean Sum of Squares m∑	F	Level of Significance (p value)
Between Groups	2	1.941	1.039	1.847	0.001*
Within Groups	16	3.526	0.526	-	
Cumulative	68.02	7.029	-		
					***p<0.05 significant**

Discussion

Saber and coworkers have calculated the exact quantity of apically pushed out debris while endodontic instrumentation. They studied these objectives with three popular file systems. Authors concluded that file design and dimensions greatly affect the quantity of apically pushed

our materials.[6] However, they also postulated that all such recommendations must be double checked before applying. Few of the other prominent researchers have confirmed that amount of pushed out debris is different with different rotary file systems. Authors found that ProTaper Next can be fairly used in order to minimize the apical pushing of debris.[7] Despite of all these research inferences, there are some researchers who claim that quantity of apically pushed out debris do not associated with infection of surrounding tissues. In fact they apparently stated that apical extrusion is an unavoidable event and it can be only minimized. They also mentioned that almost all Ni-Ti systems have this clinical problem. Their results are highly comparable to our results.[8] Researchers like Moreno and others confirmed that quantity of apically pushed material can only be minimized and not made zero. They supported and recommended few significant changes in the file design like inter blade gap and tip geometry.[9] Many other pioneer researchers have also studied these objectives and concluded similar recommendations.[10] Jain and associated in checked apical extrusion of debris by rotary Ni-Ti systems. They recommended that all almost all available rotary Ni-Ti systems have some quantity of pushed out debris.[11] Recently, some of the significant workers have shown that biomechanical preparation done with in-and-out action typically drive more debris than preparation with traditional action.[12-15] Many of the other authors studied apically extruded debris while instrumentation of oval shaped root canals. They used rotary file system supported by self-adjusting file system. They showed that even after taking superadded supports, extrusion of debris was unavoidable.[16-20] These outcomes were quite comparable with our results.

Conclusion

Authors have actually drawn very imperative points in these regards. They concluded that absolute extrusion is an unavoidable event during endodontic instrumentation. However with correct methodology and precise instruments, extrusion may be minimized. In this study, Waldent wal-flex gold rotary files expressed maximum amount of debris extrusion. Minimum amount of debris was extruded by One shape rotary files. Therefore, selection of a particular rotary system is all dependent of the situational requirements and evidences. Authors also expect other larger studies to be conducted to establish other noteworthy norms.

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