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Comparative Evaluation of Apically Extruded Debris with Protaper Gold, Reciproc Blue and Hyflex CM Instruments.

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Abstract:

Aim of study: The target of the present investigation was to compare the amount of apically extruded debris with three endodontic nickel -titanium instruments; ProTaper Gold, Reciproc Blue and Hyflex CM .

Materials and Methods: 30 mandibular premolars were separated into three groups according to the instrumentation methods (n=10) for every system, Protaper Gold, Reciproc Blue and Hyflex CM. After change of each file 5ml of 2.5% NaOCl was used as an irrigating solution with a 30G side vented irrigating needle, the apically extruded debris was collected in pre weighed glass vials, the samples were takeout and incubated at 68C⁰ for 5 days to remove the liquid. The tubes were measured again, and the contrast between the first and last weight was calculated to determine the weight of the debris. The data were statistically analysed using One-way ANOVA analyses followed by Post hoc Tukey LSD test.

Result: Data obtained were statistically analyzed using One Way ANOVA and Post hoc Tukey LSD tests. All groups showed apical debris extrusion, The ProTaper Gold systems extruded more debris in comparison with other groups(0.0421)g, also the Protaper Gold group and Hyflex CM system showed statistically significant difference (p<0.05).

Conclusions: All experimental groups produced apically extruded debris .The Protaper Gold group associated with greater apically extruded debris than other groups. While the Hyflex CM group showed the least amount of apical extrusion

Keywords: Apically Extruded Debris; Protaper Gold; Reciproic Blue and Hyflex

Introduction:

During preparation of root canals, the remaining pulp tissue, microorganisms, dentine debris and irrigation materials can be pushed after the apical foramen, (1, 2). This debris might irritate the apical tissue, creating postoperative pain, an intense inflammatory response that can cause a delay in perapical healing (3-4). Canal preparation is improved by using engine driven nickel-titanium files and modified metallurgy. ProTaper Gold (PTG) (Dentsply Maillefer, Ballaigues, Switzerland) are engine driven systems. It is a full sequence rotary system with the advance metallurgy to increased flexibility and resistance to cyclic fatigue (5), Reciproc Blue (VDW, Munich, Germany) thermally treated nickel-titanium single instrument, which is the enhanced adaptation of the first Reciproc. It has S-shaped cross-sectional outline with two cutting edges. (6) Hyflex CM (Coltene-Whaledent, Allstetten, Switzerland) files are novel NiTi system containing mechanical shaping file made of control memory wire (CM wire). These files utilize the warming and cooling methodologies to decrease cyclic fatigue, and improve canal shaping during the preparation of a curved canal (7). Aim of the current study was to compare the amount of apically extruded debris with three endodontic rotary nickel instruments; ProTaper Gold, Reciproc Blue and Hyflex CM.

Materials and Methods:

Thirty mandibular single-rooted premolars were chosen from this examination. Any soft tissue remainders and calculi on the outer root surface were scaled with hand and ultrasonic devices. Teeth with more than one canal and apical foramen, an immature root apex, root canal treatment, and a root curvature of more than 10° were excluded from the study.(8,9). A coronal access to the canal cavity was performed with Gates–Glidden drills, combined with a low-speed contra-point handpiece and irrigation with 1mL of distilled water. The working length (WL) was established at 1-mm short of the root length at the apical foramen using size 15 K-file (10). Pre-weighed glass vials (10mL) were utilized for debris collection. Every vial was re-measured, and the mass of debris was determined by subtracting the vial weight following root canal preparation from the original vial weight (11,12). Samples were haphazardly separated into three groups as per the instrumentation techniques utilized (n= 10).

Group (I): The canal prepared with Protaper Gold (Dentsply Maillefer, Ballaigues, Switzerland) file system was used with (X-Smart) at 300 rpm/ torque 400gcm. Following sequence was used SX file (size 18, 0.10 taper), S1 (size 18, 0.10 taper) and S2 (size 20, 0.10 taper) files, F1 (size 20, 0.07 taper) file, and F2 (size 25, 0.08 taper) file till full working length

Group (II): The canal prepared with Reciproc Blue (VDW, Munich, Germany), the instrumentation was performed using in-and-out pecking movement until working length by endo

engine from VDW silver at 300 rpm ,R25\08 as a master file.

Group (III): The root canals were prepared with Hyflex (CM) (Coltene-Whaledent, Allstetten, Switzerland), gentle in-and-out movement was utilized during instrumentation. These files were utilized as the producer guidance with the grouping of 25/0.008 at two third of the WL and 25/0.06 at the WL.

After change of each instrument, 5ml of 2.5% NaOCl was used as an irrigating solution with a 30G side vented irrigating needle. The apically extruded debris was collected in pre weighed glass vials , tooth were isolated from the vial, and the apical third of the tooth was washed with 1 ml of distilled water to collect debris that had adhered to the root surface. The vials were then put away in an oven at 68°C for 5 days to dissipate water. After the desired period of 5 days, the weight of extruded debris was measured subtracting the pre-weighed vials from the vials containing debris (13)

Results:

The results of this study showed that all groups resulted in extrusion of debris. The mean and standard deviation values for each experimental group were showed in (Table 1). The Protaper Gold group showed highest mean values of extruded debris (0.0421)g followed by Reciproc Blue group(0.0214)g ,While Hyflex CM group showed lowest mean values of extruded debris(0.0182)g. ANOVA test showed a significant difference among groups ($P<0.05$) (Table 2). The Post hoc Tukey LSD test was performed for multiple comparisons between groups which showed that

group Protaper Gold had a significant difference with Hyflex CM group ($P<0.05$), while Protaper Gold showed non-significant difference with Reciproc Blue group($P>0.05$). Also showed there non-significant differences between Reciproc Blue group and Hyflex CM group ($P>0.05$) in (Table 3).

Discussion:

Removing necrotic and vital pulp tissues, microorganisms and their poisons from the tooth is critical for the outcome of the endodontic treatment. This is achieved by joining mechanical instrumentation and irrigation protocol (14,15). Particularly in the apical third, strip formed and oval canal, and in a large portion of the unpredictable anatomical structures (isthmus and anastomosis) cannot be cleaned effectively; subsequently, microorganisms in the untouched regions can endure (16,17). Irrigation is one of the most significant aspect of root canal therapy, and irrigant materials system should reach all canal spaces for adequate cleaning and disinfection. of the canals for the most ideal adequacy (18).

Extrusion of irrigants, dentinal chips, debris, and microorganisms to periapical tissues is unavoidable during root canal treatment. These expelled substances may prompt irritation, postoperative pain, as well as delay in perapical healing (19,20,21). All instrumentation techniques, whether manual, rotation and reciprocation movements showed the expulsion of debris apically (22,23).

In the present examination, the Protaper Gold group showed the greatest amount of apically extruded debris when compared to the other tested groups and a significant difference with Hyflex CM file systems. This may be the effect of the larger number of files that produce the biggest amount of debris, design and a flutes plan that have different taper. Additionally, the tapering of Protaper Gold files favors the preparation of the apical part as soon as the instrumentation begins thus wear occurs early throughout the entire canal because the file reaches the working length at the beginning of the preparation causing greater apical extrusion (24,25)

While the Hyflex/CM group revealed less amount of extruded debris than other test groups. The Hyflex (CM) file system was produced for use in continuous rotation and is made out of a special treated NiTi alloys. This CM alloy undergoes thermomechanical surface treatment that could reduce the cutting efficiency and the amount of collected debris (26).

In this study, the Reciproc Blue group showed lower amount debris extruded than Protaper Gold group, this may be affected by the Reciproc Blue file design. The file has S-shape cross-area and a bigger space to suit dentine debris, no radial lands, thermally improved raw material and non-cutting tip for a delicate treatment close to the apex (27,28).

Conclusion

within the limitation of this in vitro study, the Protaper Gold and Reciproc Blue instrumentation systems were associated with great debris extrusion when compared with Hyflex CM system

Conflicts of Interest

The author reported that there is no conflict of interest

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(Table 1) The mean values of amount of apically extruded debris (in g) SD, Max and Min for all groups

Groups	N	Mean	SD	Max.	Min.
Protaper Gold	10	0.0421	0.00860	0.0437	0.0401
Reciproc Blue	10	0.0214	0.00671	0.0224	0.198
Hyflex CM	10	0.0182	0.00334	0.0186	0.0172

(Table 2): ANOVA of apical extrusion between tested groups files

Variables	Sum of Squares	d.f	variance	F	P	Sig.
Between Groups	0.0034	2	0.0017	4.0903	0.02	S
Within Groups	0.0111	27	0.0004			
Total	0.0145	29	0.000			

$p < 0.05$ Significant (S)

(Table 3): LSD test for mean extruded debris in (g) between each two groups

groups		Mean Difference	p-value
Protaper Gold	Reciproc Blue	0.0207	0.0757 (NS)
	Hyflex CM	0.0014	0.0356 (S)
Reciproc Blue	Hflex CM	0.0032	0.933(NS)

P ≥ 0.05 Non-Significant (NS); p<0.05 Significant (S)