

Comparative Evaluation of Apically Extruded Debris during Rootcanal Preparation Using Hyflex-Cm, Reciproc Blue and One Curve- An In-Vitro Study

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Abstract

Aim: The purpose of this in-vitro study was to compare the amount of apically extruded debris from extracted teeth using HYFLEX-CM, RECIPROC BLUE AND ONE CURVE.

Methods: 60 extracted single rooted mandibular premolar human teeth were randomly divided into 3 groups (n=20).Premolars were instrumented using one of the

following instruments HYFLEX-CM(HCM), RECIPROC BLUE (REC Blue) AND ONE CURVE (OC).

Pre-weighted Eppendorf tubes were used to collect the apically extruded debris during instrumentation. Then the amount of debris collected was calculated by subtracting the weight of the Eppendorftube before and after preparation. Then the data was analysed using kruskal-wallis test. At 0.5 significant level.

Results:-Some amount of debris extrusion was found with all the instruments from the apex. HCM extruded significantly less debris from the apex than OC and REC Blue. The difference among the OC and REC Blue was not that significant.

Conclusions: Under the limitations of this in-vitro study, the amount of apically extrusion of the debris measured for the used instruments was REC Blue > OC > HCM.

Keywords: Apical extrusion, Curve One, Reciproc Blue.

Introduction

One of the main reason for the flare up of root canal treatment is the apical extrusion of the debris from the canal space. Dentin & pulp tissue debris, microorganisms, and irrigation solution may extrude into periradicular tissue during the preparation.¹ This may be characterised by pain, swelling leading to the emergency visit of the patient to the clinic^{2,3,4} which intern leads to delayed healing.

If we take any instrument and technique per se, all may cause extrusion of the debris during canal preparation, irrespective of through control of working length^{5,6} the amounts of extrusion is influenced by the kinematics and the design of the file⁷.

The hyflex CM-multiple file system (colten whaledent, cuyahoga Falls, OH USA) was developed for the use in continuous rotation and it is composed of modified NiTi alloy, this alloy undergoes controlled memory (CM) thermomechanical surface treatment which increases the fatigue resistance⁸. Due to the lack of shape memory, this system enables visual functionality verification. The shape & strength of the file with straightened spirals can be restored during reuse & autoclaving, but if they do not return to their original shape, should be discarded⁹.

RECIPROC BLUE :- (REC Blue, VDW) an updated system from reciproc (VDW, Munich, Germany) a single

file system used in reciprocation. REC Blue presents design features similar to RECIPROC with an S-Shaped horizontal cross-section and two cutting edges, but the structure of the file has been improved with the new heat treatment to make it more flexible^{10,11} this new heat treatment gives a Blue Colour to the file.

One Curve: One Curve is a single-use, heat-treated NiTi rotary file that enables shaping of the full length of the canal with a single instrument, directly to the apex.

C-wire defines One Curve's personality traits as its own DNA. One Curve is a smart, efficient, and conservative instrument manufactured by Micro-Mega Company. The advantages of One Curve, single-file technology are increased blade flexibility and more separation resistance resulted from C-wire heat treatment CM of NiTi material. Perfect taper and diameter for a final shaping that meets standards of an optimized cleaning and shaping preserves the original anatomy of the root canal^{12,13,14}.

Methodology

selection of the samples

Total of 60 mandibular premolar teeth that had been extracted for the orthodontic purpose with intact root, complete root formation and non-carious lesion were selected for the studies. Teeth with similar length (19 ± 1 mm) and straight canals were selected ($< 10^0$) tooth's soft and hard tissue debris was removed from the surface and disinfected in a solution of 0.1% thymol for 24 hrs and stored in saline until they were used. Endodontic access was done, canal was negotiated with #10 till the file is visible at the apex, then its root length was adjusted by reducing the crown, such that the total length is 19 mm, with carborundum disk then the working length was set 1 mm short of apical foramen. Total 60 teeth were segregated into with 20 teeth in each category.

Apparatus Preparation: The experiment model described by Myers and Montgomery et al¹⁵ was used to calculate the debris. Eppendorf tubes were numbered for each sample and hole was made in its lid. First the Eppendorf tube was measured 5 times on a analytical balance with accuracy of 0.0001gm, then the lightest & the heaviest weight was discarded, then the mean of the remaining 3 weights was taken as the starting weight of the tube. To prevent the leakage, the apparatus was covered with rubber dam sheet after fitting root in the tube with cyanoacrylate. The Eppendorf tube was placed in opaque bottle to avoid operator's error. 27 gauge needle was bent and inserted in the Eppendorf lid to balance the external and internal pressures.

Root Canal Preparation: Single operator was selected to do all endodontic procedure. In all groups after access the root canal irrigation done with 2ml of distilled water with 30 gauge needle. Whenever the file is removed from the canal, recapitulation done with #10 K file to working length. This procedure is repeated for 5 times and 10ml of irrigation solution was used to finish the preparation in each group^{16, 17}.

1. Reciproc blue group :- In reciproc blue R25 group the file was used with reciprocating motion according to the manufacture recommendations using silver reciproc endodontic motor (VDW) the files were used with gentle strokes with pecking movement.
2. Hy-Flex CM (HYF) group:- The single-length technique was used to prepare⁹ the canal using 25/.05 , 20/0.4 , 25/0.4 , 20/0.6 , 30/0.4 & 40/0.4. The files were used with VDW with the speed of 500rpm & torque of 2.5N. Each sorted kit was used 3 times and then discarded.
3. One Curve: OC single rotary file (Micro-Mega) using X-Smart Plus endodontic electro motor at a constant speed

of 300rpm and 2.5 N×cm to rotate in a crown down manner until reaching full WL following manufacturer's instructions. The final weighing of Eppendorf tubes:-After the root canal preparation, Eppendorf tubes were removed and then teeth were removed and each apparatus was placed in incubation at 37° c in biological incubator for 15 days to evaporate the remaining amount of irrigation solution from the tubes. Then the final weight was taken the way initial weight was taken. Then the initial weight is deducted from the final weight. To compare the results among the groups the data was analysed using Kruskal-wallis test.

Apical debris extrusion for each group was tabulated in table 1

Table 1: median, minimum and maximum, extrusion quantity (grams), and number of teeth per group (n)

Group	N	Median	Maximum	Minimum
Reciproc blue	20	0.0051	0.0068	0.0028
HyCM	20	0.0027	0.0033	0.0012
OC	20	0.00325	0.0042	0.0022
p-value	0.0027			

Discussion

Apical extrusion (AED) of the debris is one of the main reasons for flare ups. Any system we use some amount of extrusion is seen^{1,2} many newer file systems are getting introduced every year in endodontics. In this study we have taken HCM, REC Blue and OC, which is not yet compared till now. The number of instruments and kinematics may contribute to debris extrusion during instrumentation²². All file systems in our study showed some degree of extrusion of debris from the apex, which holds true in all file systems^{23,24}. AED depends on many factors, like instrument types and size, instrument techniques and preparation end point and irrigation solution.

HCM file facilitates penetration into the canal and presents a root canal shape corresponding with original anatomy. The cross-section is almost triangular at top, trapezoidal at middle, quadratic at tip. It works with the continuation motion, which improves coronal transportation of dentin debris by acting like screw conveyor^{7,23,25} which is in consistent with our and with the other studies too.

REC Blue used in reciprocating motion and are recommended for single use. Reciprocating motion improves the resistance of nickel titanium instruments to cyclic fatigue, back and forth motion of amplitude of 3mm. Horizontal cross-section is S-Shaped and two cutting edges, so greater cutting efficiency because of this it contributes to more extrusion of the debris from apex in our study.

OC file is a newly introduced file, there is no study in the literature, which can be used in directly comparing with the present results. OC Files have unique asymmetrical cutting pro file, which improves its snake like movement in to the canal and therefore may causal essentially extruded debris and preserve the original canal shape^{18, 19}. In addition to safety tip of size 25, continuous taper of 0.06 and variable pitch which reduces in strumpets crewing effects^{18, 20}. OC instruments which incorporate variety of different cross-sectional on the active length of the file of first an improved cutting action in the Root canal more amount of dentine removal is recorded in OC because of its heat treatment, C-wire technology which increases the instrument flexibility and decreases the screwing effect²¹.

The tip taper also influence the extrusion outcome. Reciproc blue features a decreasing taper from D₃-D₁₆, and greater taper at the tip which promotes greater extrusion. HCM features a continuous taper causes less extrusion which is in consistent with other studies³.

Extrusion of debris is less using crown-down pressure less technique when compared with the step-back technique^{23,26} this is because rotation of instruments tend to pull the dentinal debris into the flutes of the files and directs it towards the coronal aspect avoiding its compaction within the root canal²⁷.

The number of instruments may contribute to debris extrusion during the instrumentation²². Multiple file groups shows less extrusion than single file group which is in agreement with previous studies²³ but some studies shown there is no difference in the results using single or multiple files⁷.

The amount of apical extrusion of debris is more with reciprocation movement compared to continuous rotation because reciprocation acts as a mechanical piston which increases AED^{20,23}.

Conclusion within the limitations of this in-vitro study, the amount of AED, for different file system tested was REC Blue > OC > HCM further

References

1. Uslu G, Özyürek T, Yılmaz K, Gündoğar M, Plotino G. Apically extruded debris during root canal instrumentation with Reciproc blue, HyFlex EDM, and XP-endo shaper nickel-titanium files. Journal of endodontics. 2018 May 1;44(5):856-9.
2. Surakanti JR, Venkata RC, Vemisetty HK, Dandolu RK, Jaya NK, Thota S. Comparative evaluation of apically extruded debris during root canal preparation using ProTaper™, Hyflex™ and Waveone™ rotary systems. Journal of conservative dentistry: JCD. 2014 Mar;17(2):129.
3. Harrington GW, Natkin E. Midtreatment flare-ups. Dental Clinics of North America. 1992 Apr;36(2):409-23.
4. Reddy SA, Hicks ML. Apical extrusion of debris using two hand and two rotary instrumentation

- techniques. *Journal of endodontics*. 1998 Mar 1;24(3):180-3.
5. Tinaz AC, Alacam T, Uzun O, Maden M, Kayaoglu G. The effect of disruption of apical constriction on periapical extrusion. *Journal of endodontics*. 2005 Jul 1;31(7):533-5.
 6. Arslan H, Doğanay E, Alsancak M, Çapar ID, Karataş E, Gündüz HA. Comparison of apically extruded debris after root canal instrumentation using Reciproc® instruments with various kinematics. *International Endodontic Journal*. 2016 Mar;49(3):307-10.
 7. Koçak S, Koçak MM, Sağlam BC, Türker SA, Sağsen B, Er Ö. Apical extrusion of debris using self-adjusting file, reciprocating single-file, and 2 rotary instrumentation systems. *Journal of Endodontics*. 2013 Oct 1;39(10):1278-80.
 8. Braga LC, Silva AC, Bueno VT, de Azevedo Bahia MG. Impact of heat treatments on the fatigue resistance of different rotary nickel-titanium instruments. *Journal of endodontics*. 2014 Sep 1;40(9):1494-7.
 9. ColteneEndo. File sequence step by step card.
 10. De-Deus G, Silva EJ, Vieira VT, Belladonna FG, Elias CN, Plotino G, Grande NM. Blue thermomechanical treatment optimizes fatigue resistance and flexibility of the Reciproc files. *Journal of endodontics*. 2017 Mar 1;43(3):462-6.
 11. Gündoğar M, Özyürek T. Cyclic fatigue resistance of OneShape, HyFlex EDM, WaveOne gold, and Reciproc blue nickel-titanium instruments. *Journal of endodontics*. 2017 Jul 1;43(7):1192-6.
 12. Ghoneim WM. Effect of heat treatment on the centering ability and dentin removal of a nickel–titanium single file rotary system. *Tanta Dental Journal*. 2019 Apr 1;16(2):68.
 13. Kuzekanani M. Nickel–Titanium rotary instruments: Development of the single-file systems. *Journal of International Society of Preventive & Community Dentistry*. 2018 Sep;8(5):386.
 14. Yılmaz K, Özyürek T, Uslu G. Comparison of Cyclic Fatigue Resistance of One Curve, HyflexEdm, Waveone Gold and Reciproc Blue Nickel-Titanium Rotary Files at Intra-Canal Temperature. *Cumhuriyet Dent J* 2019;22:1:42-47
 15. Myers GL, Montgomery S. A comparison of weights of debris extruded apically by conventional filing and Canal Master techniques. *Journal of endodontics*. 1991 Jun 1;17(6):275-9.
 16. Lu Y, Wang R, Zhang L, Li HL, Zheng QH, Zhou XD, Huang DM. Apically extruded debris and irrigant with two Ni-Ti systems and hand files when removing root fillings: a laboratory study. *International endodontic journal*. 2013 Dec;46(12):1125-30.
 17. Yılmaz K, Özyürek T. Apically extruded debris after retreatment procedure with Reciproc, ProTaper Next, and Twisted File Adaptive instruments. *Journal of endodontics*. 2017 Apr 1;43(4):648-51.
 18. Bürklein S, Benten S, Schäfer E. Shaping ability of different single-file systems in severely curved root canals of extracted teeth. *International endodontic journal*. 2013 Jun;46(6):590-7.
 19. Alrahabi M, Alkady A. Comparison of the shaping ability of various nickel–titanium file systems in simulated curved canals. *Saudi Endodontic Journal*. 2017 May 1;7(2):97.
 20. Bürklein S, Benten S, Schäfer E. Quantitative evaluation of apically extruded debris with different single-file systems: Reciproc, F 360 and One Shape versus M two. *International endodontic journal*. 2014 May;47(5):405-9.

21. Kuhn G, Jordan L. Fatigue and mechanical properties of nickel-titanium endodontic instruments. Journal of Endodontics. 2002 Oct 1;28(10):716-20.
22. Tanalp J, Güngör T. Apical extrusion of debris: a literature review of an inherent occurrence during root canal treatment. International endodontic journal. 2014 Mar;47(3):211-21.
23. Bürklein S, Schäfer E. Apically extruded debris with reciprocating single-file and full-sequence rotary instrumentation systems. Journal of endodontics. 2012 Jun 1;38(6):850
2.
24. Borges AH, Pereira TM, Porto AN, et al. The influence of cervical preflaring on the amount of apically extruded debris after root canal preparation using different instrumentation systems. J Endod 2016;42:465–9.
25. Kirchhoff AL, Fariniuk LF, Mello I. Apical extrusion of debris in flat-oval root canals after using different instrumentation systems. Journal of endodontics. 2015 Feb 1;41(2):23741.
26. ZarrabiMH,BidarM,JafarzadehH. An *in vitro* comparative study of apically extruded debris resulting from conventional and three rotary (Profile, Race, FlexMaster) instrumentation techniques. J Oral Sci 2006;48:85-8.
27. GoerigAC, MichelichRJ, SchultzHH. Instrumentation of root canals in molar using the step-down technique. J Endod 1982;8:550-4.