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Original Study

Evaluation of remaining pericervical dentin thickness using various orifice shapers under CBCT – an in vitro study

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ABSTRACT

Aim

The aim of this study was to evaluate the remaining peri-cervical dentin thickness using various orifice shaper under Cone Beam Computed Tomography (CBCT).

Materials and Methods

Forty-five freshly extracted mandibular first molars with root curvature between 20˚- 35˚ were taken and divided into fifteen teeth per group as Group1- Gates-Glidden drills, Group 2- Hyflex CM and Group 3- ProTaper Universal orifice shaper SX. All the teeth were embedded into acrylic resin block. The working length of each specimen was taken with an apex locator and confirmed with a radiograph. Access cavity preparation were made, and the canals were located. The distal roots were cut 1mm below the furcation and initial root canal preparation was done. Pre-operative Cone Beam Computed Tomography (CBCT) imaging was done. Then 0.5mm axial cross section were obtained at 1mm distance. The measurements were done by taking the mean from labio-lingual diameter and mesio-distal diameter using image analysis. The orifice was enlarged according to the assigned groups Each orifice shaper was used 5 times and then replaced by a new one before taking post-operative CBCT.

Results

There was a statistically significant difference in GROUP 2: Hyflex as compared to GROUP 1: GG drills and GROUP 3: ProTaper Universal. Although there was no statistical difference between GROUP 1: GG drills and GROUP 3: ProTaper Universal.

Conclusion

The Hyflex orifice shapers resulted in preservation of more dentin than GG drills and ProTaper orifice shapers.

***Keywords:** Peri-cervical dentin, Orifice shaper, Hyflex CM*

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INTRODUCTION

In modern endodontics the conservation of pericervical dentin is a major challenge among practitioners. Peri-Cervical Dentin (PCD) is the dentin near the alveolar crest. Ruddles et al., stated that the dentin which is present near alveolar crest is irreplaceable. Enlarging the orifice plays a major role in the root canal therapy, it provides easy access through the canal for cleaning and shaping and provides the operator better control of instruments [18]. Greater access through the orifice provides better penetration of irrigant inside the root canal for the successful endodontic therapy [18].

There are various instrumentation technique for enlarging the orifice. The removal of peri-cervical dentin should be as minimal as possible, but it should not compromise the thorough cleaning shaping of root canal. The ideal endodontic preparation depends on enlarging the orifice which is one of the major factors at the same time it shouldn't weaken the tooth structure which might lead to fracture. The ideal orifice shaper should enlarge the canal without any deviation from the original curvature [19].

Gates Glidden drills which were introduced in 1855, are commonly used orifice shapers from early days. It has various sizes which can be used according to the size of the tooth. Some rotary instrument system contains orifice shapers namely ProTaper and Hyflex.

Unlike other diagnostic methods, CBCT is the widespread upgraded technology which is highly used in the field of dentistry. It has three dimensional techniques and 200-degree rotation over the region of interest to provide the needed data [20]. In this study CBCT was utilized for calculating the remaining pericervical dentin thickness using image analysis.

The objective of this study was to evaluate the remaining peri-cervical dentin thickness using various orifice shaper under Cone Beam Computed Tomography (CBCT).

MATERIALS AND METHODS:

Forty-five freshly extracted mandibular first molars were selected in the study and were divided into fifteen teeth per group as Group 1 – Gates-Glidden drills (Dentsply-Maillefer, Ballaigues, Switzerland), Group 2- Hyflex CM (Coltène Waldent) orifice shaper and Group 3- ProTaper Universal (Dentsply Maillefer, Switzerland) orifice shaper SX. According to Schneider's technique [16], the teeth with root curvature between 20˚ - 35˚ were taken into consideration. All the teeth were embedded in the acrylic resin block which was measuring 20mm in height and 20mm in width. The working length of each specimen was taken with apex locator (Root ZX - J. Morita Mfg. Corp, Kyoto, Japan) and confirmed it with radiograph. The standard access cavity preparation were made with Endo access kit (Dentsply Maillefer, Switzerland). The canals were located followed by which the distal roots were cut 1mm below the furcation area and initial root canal preparation was done with size #10, #15K and #20K files (Mani) under copious irrigation with 2.5% NaOCl and 17% EDTA. Pre-operative Cone Beam Computed Tomography (CBCT) imaging was done using Orthophos SL (ORTHOPHOS XG GALILEOS, Germany) with 70kVp, 5mA and 10sec time and FOV= 8x5cm. Then 0.5mm axial cross section were obtained at 1mm distance. The measurements were done by taking the mean from labio-lingual diameter and mesio-distal diameter using image analysis. The orifice was enlarged according to the assigned groups and manufacturers instruction were followed. Each orifice shaper was used 5 times and then replaced by new one. The GG drills (Dentsply-Maillefer, Ballaigues, Switzerland) were used in the sequence of GG#3, GG#2, GG#1 (i.e.) crown down order at the rotational speed of 2500 rpm and then the post-operative

CBCT was taken.

RESULTS:

The values were calculated using SPSS software 20.0

Table1: Comparison of PCD thickness (means ± standard deviations) of orifice shapers (n=15)

Groups	Mean ± S. D
1: GG drills	0.93±0.34[a]
2: Hyflex CM	1.08±0.09[b]
3: ProTaper Universal	0.88±0.12[a]

Mean values within each row sharing same superscript (a) showed no significant difference ($p>0.05$)

There was a statistically significant difference in GROUP 2: Hyflex as compared to GROUP 1: GG drills and GROUP 3: ProTaper Universal. Although there was no statistical difference between GROUP 1: GG drills and GROUP 3: ProTaper Universal. The data was analysed by using one way analysis of variance and post hoc Tukey test. The significance level was set at 0.05.

DISCUSSION

All the specimens were instrumented by the same operator as the ability of the operator seems to be an important factor in instrument failure [1]. The orifice shapers were used only 5 times and it was replaced by a new one as it might tend to fracture [2]. The initial root canal preparation was done till #20 k-file in all the specimen till working length as it provides safer use of gates Glidden drill and other rotary files [3] An excessive coronal flaring can lead to strip perforation [4]. Previous Studies stated that ProTaper are safer when used in coronal flaring [5,6] but then in our study it showed a contradicting result.

Simulating the clinical situation, this study evaluation was done considering the danger zone furcation area [13,14,15]. The samples which were considered in this study had 20˚- 35˚root canal curvature either in Bucco-lingual or mesio-distal radiographs [7,15]. An important methodological aspect of selecting the mesio-buccal root in this study is because Mahran et al., evaluated a study in the coronal portion of MB canal of the mandibular first molar [15] and Berutti et al.,[17] stated that the thickness of root is smallest in the mesial canal in the mandibular first molar which are within 1.5mm of the furcation. Previous studies have stated that the coronal third (i.e., 3 to 4mm) below the orifice tends to be sensitive during the preparation of root canal with rotary instrument in mesial canals of molar teeth [10,11,12].

The radiographic tasking in our study was CBCT (Cone beam computed Tomography) which is shown to be more efficient than CT (Computed Tomography) in dentistry [8]. Due to higher significance of CBCT imaging it gives clinicians high diagnostic quality and sub-millimeter spatial resolution images with relatively short time intervals (10–70 seconds) [9].

However according to the manufactures guide, ProTaper were used upto 250 rpm and Hyflex orifice shaper were used upto 500 rpm. When it comes to GG drills, they are still popular because of its high cutting efficiency and low cost [7], it is used conventionally but it is inflexible, and the rpm is uncontrollable as well.

In our study the amount of dentin removal was higher in ProTaper followed by GG drills and Hyflex. The ProTaper and Hyflex both have a negative rake angle of -35˚(convex triangle) and -31˚(triangular) respectively whereas GG drills has a wide rake angle (flame shaped) and side cutting. However, the Hyflex has a 0.08/25 taper which is lesser resulting in preservation of more dentin comparatively. And, it has a unique NiTi M-wire treatment that controls material's memory which makes the file extremely flexible without rebounding and provide superior canal tracking [21]. The higher flexibility and canal centering ability also could be the reason for preservation of dentin as the instrument which passes closely to canal anatomy without removing excessive dentin. Further research should focus on the metallurgy of instrument to preserve peri-cervical dentin.

CONCLUSION

Within the limitations of the present study, the Hyflex orifice shapers resulted in preservation of more dentin than GG drills and ProTaper orifice shapers. Further in-vivo studies with longer follow up period could be done to validate the present finding.

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Conflicts of interest - There are no conflicts of interest.

REFERENCES

1. Mandel, E, Adib-Yazdi, M, Benhamou, L-M, Lachkar, T, Mesqouez, C, Sobel, M. Rotary Ni-Ti ProFile systems for preparing curved canals in resin blocks: influence of operator on instrument breakage. Int Endod J. 1999; 32:436–443.
2. Martin LR, Gilbert B, Dickerson AW. Management of endodontic perforations. Oral Surg Oral Med Oral Pathol Radiol Endod. 1982; 54:668-77.
3. Weine FS, Kelly RF, Lio PS. The effect of preparation procedures on original canal shape and apical foramen shape. J Endod 1975; 1: 255-262.
4. Sauáia TS, Gomes BP, Pinheiro ET, Zaia AA, Ferraz CC, Souza-Filho FJ, Valdrighi L. Thickness of dentine in mesial roots of mandibular molars with different lengths. Int Endod J. 2010 Jul;43(7):555-9. [Medline: 20636516] [doi: 10.1111/j.1365-2591.2010. 01694.x
5. Carvalho-Sousa B, Costa-Filho JR, Almeida-Gomes F, Maníglia-Ferreira C, Gurgel-Filho ED, Albuquerque DS. Evaluation of the dentin remaining after flaring using gates glidden drills and protaper rotary files. RSBO. 2011; 8:194–9.
6. Zhang L, Luo HX, Zhou XD, Tan H, Huang DM. The shaping effect of the combination32-of two rotary nickel-titanium instruments in simulated S-shaped canals. J Endod. 2008; 34:456–8.

7. Akhlaghi NM, Naghdi A, Bajgiran LM, Behrooz E. Computed tomography evaluation of residual root thickness after pre-flaring using gates Glidden drills: The sequence effect. J Conserv Dent. 2014; 17:142–5.
8. Dawood A, Patel S, Brown J (2009) Cone beam CT in dental practice. Br Dent J 207:23–28.
9. W. C. Scarfe, A. G. Farman, and P. Sukovic, "Clinical applications of cone-beam computed tomography in dental practice," Journal of the Canadian Dental Association, vol. 72, no. 1, pp. 75–80, 2006.
10. Abou-Rass M, Frank AL, Glick DH. The anticurvature filing method to prepare the curved root canal. J Am Dent Assoc. 1980; 101:792–4.
11. Kessler JR, Peters DD, Lorton L. Comparison of the relative risk of molar root perforations using various endodontic instrumentation techniques. J Endod. 1983; 9:439–47.
12. McCann JT, Keller DL, LaBounty GL. A modification of the muffle model system to study root canal morphology. J Endod. 1990; 16:114–5.
13. Coutinho-Filho T, De-Deus G, Pinto TG, Gurgel-Filho ED, Maniglia-Ferreira C. A computer evaluation of the dentin remaining after cervical preparation in curved canals: Gates-glidden drills vs orifice shaper. Braz J Oral Sci. 2002; 1:116–20.
14. Plotino G, Grande NM, Falanga A, Di Giuseppe IL, Lamorgese V, Somma F. Dentine removal in the coronal portion of root canals following two preparation techniques. Int Endod J. 2007; 40:852–8.
15. Mahran AH, AboEl-Fotouh MM. Comparison of effects of ProTaper, HeroShaper, and Gates Glidden Burs on cervical dentin thickness and root canal volume by using multislice computed tomography. J Endod. 2008; 34:1219–22.
16. Schneider SW. A comparison of canal preparations in straight and curved root canals. Oral Surg Oral Med Oral Pathol. 1971; 32:271–5.
17. Berutti E, Fedon G. Thickness of cementum/dentin in mesial roots of mandibular first molars. J Endod.1992;18:545–8.
18. Johnson WT, Noblett WC. Cleaning and Shaping. In: Torabinejad M, Walton ER, editors. Endodotics Principles and practice. 4th ed. St. Louis: Mosby; 2009. pp. 258–60.
19. Elsherief SM, Zayet MK, Hamouda IM. Cone-beam computed tomography analysis of curved root canals after mechanical preparation with three nickel–titanium rotary instruments. J Biomed Res. 2013; 27:326–35.
20. Scarfe WC, Levin MD, Gane D, Farman AG. Use of cone beam computed tomography in endodontics. Int J Dent2009; 2009:634567.
21. Y Shen, HM Zhou, YF Zheng, B Peng, M Haapasalo. Current challenges and concepts of the thermomechanical treatment of nickel-titanium instruments. J Endod. 2013;39(2):163–172.

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