



COMPARATIVE EVALUATION OF REMAINING DENTIN THICKNESS POST INSTRUMENTATION WITH THREE DIFFERENT SINGLE ROTARY FILE SYSTEMS – AN IN VITRO CBCT STUDY

¹Dr. Sarjeev Singh Yadav, ²Dr. B. Vinay Goud, ³Dr. Zainab Ateeq, ⁴Dr. Ambati Shilpa Reddy, ⁵Dr. Prathibha Paturu, ⁶Dr. Akbar Khan

¹ Professor and Head, Department of Conservative Dentistry & Endodontics, Government Dental College and Hospital, Hyderabad.

² Senior Resident, Department of Conservative Dentistry & Endodontics, Government Dental College and Hospital, Hyderabad.

^{3,4,5,6} Post Graduate students, Department of Conservative Dentistry & Endodontics, Government Dental College and Hospital, Hyderabad.

Conflicts of Interest: Nil

Corresponding author: Dr. Sarjeev Singh Yadav

Abstract:

Aim & Objectives: The aim of the study is to evaluate the Effective Remaining Radicular Dentin Thickness of the root canal after instrumenting with three different single rotary file systems with CBCT Imaging.

Methodology: 45 non carious intact mandibular premolars were selected for the study. Preoperative CBCT Scanning was done. Access cavity was prepared and working length determination was done. The teeth were then divided into 3 groups, Group I – Teeth instrumented with Hyflex EDM rotary file, Group II – Teeth instrumented with One curve Rotary File, Group III – Teeth instrumented with S-One Rotary File. The teeth were then prepared for CBCT Scanning. Results were evaluated and statistical analysis was done using One-way ANOVA and Tukey post hoc test.

Results: Using One way ANOVA, ($p < 0.001$) Highest Remaining Dentin Thickness was found in Group III, followed by Group II and Group I. Group I showed the least remaining dentin thickness when compared to Group II and Group III. All the intergroup comparisons were found to be non-significant in terms of remaining dentin thickness after biomechanical preparation using various single file systems.

Conclusion: Within the limitations of this study, Highest remaining radicular dentin thickness was found in S-One Single file system followed by One Curve file and the least remaining radicular dentin thickness was found in Hyflex EDM File system.

Keyword: Remaining Dentin Thickness, Single file system, CBCT, Biomechanical preparation

Introduction

The shaping of root canal is one of the most important steps in canal treatment which aims to achieve complete removal of the vital pulp or the necrotic tissue to create sufficient space for canal irrigation^[1]. NiTi rotary instrumentation was introduced in 1980s which has made endodontics easier and faster than manual instrumentation, resulting in a consistent and predictable root canal shaping. The residual or the remaining dentin thickness following intraradicular procedures relates to the fracture resistance of the root. If the pre-instrumentation root canal wall thickness is quite less, it plays a vital role in selecting the file system that reduces the canal wall to a minimum level while doing biomechanical preparation of the canal to an acceptable level^[2].

Remaining Dentin Thickness is a very important variable to prevent tooth fractures. Sufficient RDT prevents tooth fractures and gives resistance form to both the tooth and restoration. 1.0 mm of Remaining or Residual Dentin Thickness (RDT) circumferential to the sound tooth

structure is required to resist possible root fracture when a prosthetic post is required to restore a tooth.

Sectioning, radiographic imaging, and muffle technique are the methods that have been used *in vitro* to determine RDT. However, sectioning and muffle technique require destructive sectioning of the specimens as well as physical reassembly of sections.^[3]

In this regard, cone-beam computed tomography (CBCT) has come up as a very essential tool, as it can measure the dentin thickness of root canal walls, due of its noninvasive nature, three-dimensional (3D) view, accuracy, and reliability, thereby serving as a crucial diagnostic tool to gauge the RDT, particularly in teeth with compromised root morphology.

Single- file shaping technique simplify instrumentation protocols and avoid the risk of cross –contamination^[4]. A single file is used for complete instrumentation for majority of root canals. It requires a minimum or no glide path The recommendation for single use has an added advantage of reduced instrument fatigue^[5]. Single-file systems reduce the working time and decrease cross

contamination between patients which is a common problem associated with the use of multiple files. It also saves time and cost. Thus the present study was conducted in order to evaluate the efficiency various single file systems, i.e., Hyflex EDM, One Curve and S-One in terms of remaining dentin thickness.

AIM & OBJECTIVE

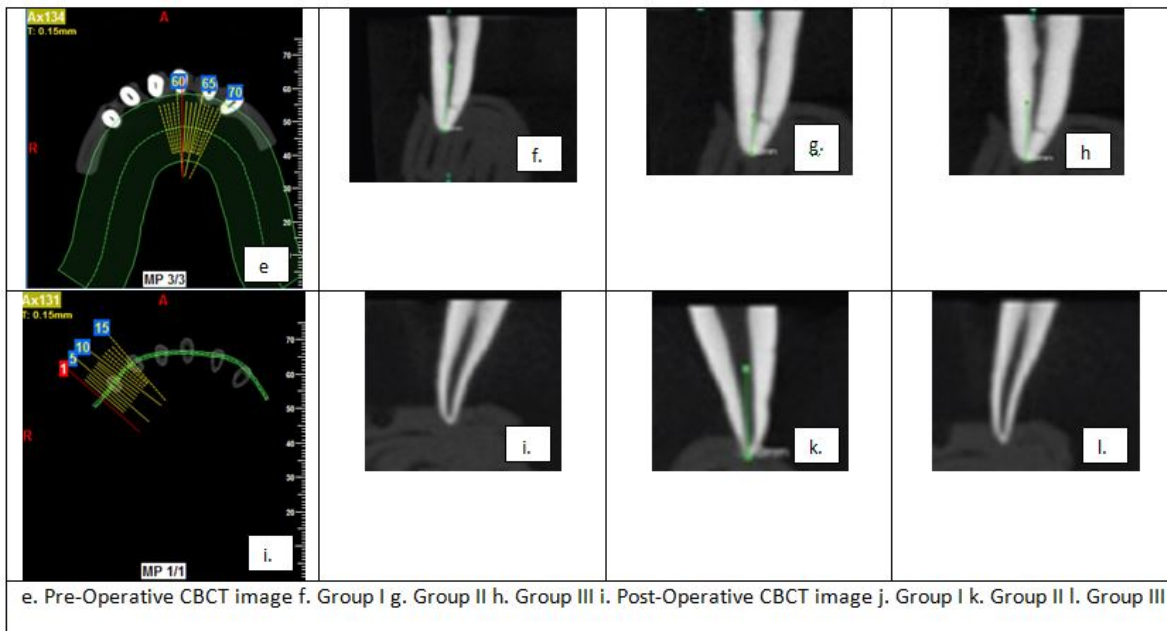
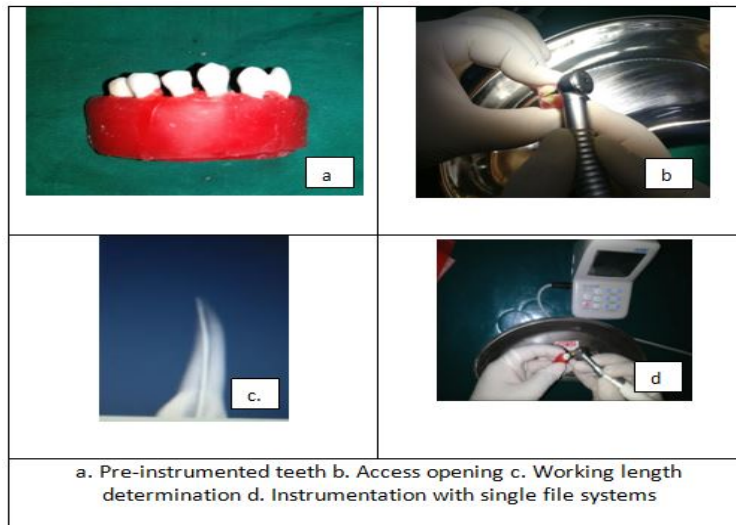
This study aims to evaluate the efficiency of various rotary single file systems, Hyflex EDM, One Curve, S – One Files, in terms of remaining dentin thickness after biomechanical preparation using CBCT study.

MATERIALS & METHODOLOGY

45 non carious intact Mandibular Premolar Teeth, extracted due to orthodontic reasons were collected. Single rooted, non-carious teeth were selected for this study. Teeth which are fractured or had open apices were excluded from the study.

Teeth were prepared for Preoperative CBCT Scanning. Pre-instrumentation cone - beam computed tomography (CBCT) scan was taken for all the samples in axial view to serve as baseline against which we could calculate the parameter of remaining dentin thickness after biomechanical preparation by various file systems. CBCT scanning parameters were 60 kv, 8 mA & 38.2 seconds.

Access cavity preparation and working lengths were determined for all teeth. The teeth were divided into three groups of 15 teeth each, according to the single file system used. Group I – Hyflex EDM, Group II – One Curve and Group III – S-One. Biomechanical preparation was done using the respective files and irrigation was done using 3% sodium hypochlorite solution (NaOCl), 17% ethylene diaminetetraacetic acid (EDTA) and 0.9% normal saline (NS). The teeth were again prepared for post-operative CBCT scanning using the same parameters.



RESULTS

Table 1: Mean value of reduced dentin thickness after biomechanical preparation with various file systems at 3 mm and 6 mm (n=15)

Group	RDT at 3 mm	RDT at 6 mm
Group I (Hyflex EDM)	0.47±0.06	0.69±0.03
Group II (One Curve)	0.36±0.02	0.46±0.02
Group III (S-One)	0.34±0.04	0.39±0.04

Table 2: Intergroup comparison of RDT after biomechanical preparation with various file systems at 3 mm and 6 mm

Group	Group	Mean difference at 3 mm	t	Mean difference at 6 mm	t	Significance
Group I (Hyflex EDM)	Group II (One Curve)	4.52	1.708	4.12	1.543	Non-significant
	Group III (S-One)	6.11	0.707	6.10	1.432	Non-significant
Group II (One Curve)	Group III (S-One)	1.51	1.543	1.63	1.708	Non-significant

Using One way ANOVA, ($p < 0.001$) Highest Remaining Dentin Thickness was found in Group III, followed by Group II and Group I. Group I showed the least remaining dentin thickness when compared to Group II and Group III. All the intergroup comparisons were found to be non-significant in terms of remaining dentin thickness after biomechanical preparation using various single file systems.

Discussion

Endodontic therapy treats within the tooth and its success is based upon the triad of thorough canal debridement, effective disinfection and obturation of the canal space^[6]. The quality guidelines of the European Society of Endodontics state that elimination of removal of debris, residual pulp tissue and maintenance of the original canal curvature during enlargement are the main objectives of root canal instrumentation^[7]. An important objective is to leave as much Radicular Dentin as possible so as not to weaken the root structure, thereby preventing vertical fractures. In this study, 3 single file systems were used. Hyflex EDM single file system (Coltene), One Curve single file system (Micro Mega) and S – One single file system.

Hyflex EDM single file system is manufactured using the technique of electrical discharge machining. The apical diameter of the tip is 0.25 mm. It has three different cross-sections, i.e., quadratic in the apical third, trapezoidal in the middle third and triangular in the coronal third. It is used at a speed of 500 rpm and torque of 2.5 N.cm^[8].

One Curve single file system is manufactured from heat treated nickel titanium. It has increased blade flexibility and higher fracture resistance. The variable cross-section

combined with continuous rotation ensures excellent cutting efficiency and a perfectly centered trajectory. It is used at a speed of 300 rpm and torque of 2.5 N.cm^[9].

S-One single file system is manufactured from heat treated nickel titanium. It has minimal radial contact ensuring better cutting efficiency. It has S-shaped cross-section in the middle and oval at the tip. It has double processed cutting edge showing improved fracture resistance. It is used at a speed of 35-400 rpm and a torque of 2.6 Ncm^[10].

In this study, the mean value of RDT after biomechanical preparation with various file systems at 3 mm and 6 mm from apical foramen was found to be highest in Group III (S-One) followed by Group II(One Curve) and least in Group I (Hyflex EDM).

S-One has shown minimum reduction in the dentin thickness when compared to Hyflex EDM and One Curve because it has minimal radial contact with the root canal with a double processed cutting edge. One Curve has shown more reduction in dentin thickness as compared to S-One due to its increased blade flexibility and variable cross-section^[11]. One Curve has shown less reduction in dentin thickness when compared to Hyflex EDM as the latter has a high shaping ability with three different cross-sections with cutting edges that cuts dentin more aggressively than the other two file systems^[12].

All the intergroup comparisons were found to be non-significant in terms of remaining dentin thickness after biomechanical preparation with various file systems at 3 mm and 6 mm from apical foramen when Group I (Hyflex EDM), Group II (One Curve) and Group III (S-One) were compared at $p < 0.001$.

There are limitations inherent in an *in vitro* study design. As these teeth were not subjected to functional forces of the oral cavity, the impact of intraradicular procedures on their survival rate cannot be estimated. The use of CBCT in clinical scenario may not always be feasible owing to the radiation exposure it causes to the patient. Thus, further research is necessary.

Conclusion

Within the limitations of this study, highest remaining radicular dentin thickness was found in S-One Single file system followed by One Curve file and the least remaining radicular dentin thickness was found in Hyflex EDM File system. When intergroup comparison was done, there is a non-significant difference between all the groups in terms of remaining dentin thickness during biomechanical preparation of the root canal.

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