IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 11 Ver. VII (Nov. 2017), PP 75-81
www.iosrjournals.org

Efficacy of Endoactivator Irrigation System for Debris Removal And Checking Apical Extrusion of Irrigating Solution Compared To Conventional Methods – A SEM Evaluation.

*Dr.Anil K Tomer[1], Dr.Panna Mangat[2], Dr.Sneha Vaidya[3],
Dr.Abhishek Bhattacharya[4], Dr.Smita Sahni[5], Dr.Afnan Raina[6]
[1,2,3,4,5,6](Conservative Dentistry and Endodontic, Divya Jyoti Dental College and Research Center, India)
Corresponding Author:Dr.Sneha Vaidya[3]

Abstract
Aim: *The purpose of the study was to evaluate the efficacy of Endoactivator in the removal of debris and checking apical extrusion of irrigating solution from root canal walls compared to conventional methods.****Methodology:****20 extracted mature human single rooted teeth were instrumented and irrigated. Teeth were divided into 2 groups. Group 1 – Conventional irrigation was performed using 2.5% NaOCl and 17% EDTA with side vented needle. Group 2 – final activation of irrigants by Endoactivator.*
Results: *The amount of extruded solution was measured by calibrated vial. This study showed that the debris removal efficacy of Endoactivator device is better in middle 1/3rd of canal compared to 2.5% NaOCl and 17% EDTA. The amount of apical extrusion of irrigating solution was less in endoactivator irrigation system compared to conventional method.*
Conclusion: *This study concluded that Endoactivator demonstrated a higher debris removal and significantly less irrigant extrusion compared to conventional methods.*
Keywords: *Apical Extrusion**,** Conventional irrigation, Debris Removal, Endoactivator, SEM.*

Date of Submission: 10 -11-2017 Date of acceptance: 23-11-2017

I. Introduction

The ultimate goal of endodontic treatment is to control the microbial factor in complex root canal anatomy, especially in the apical one third. This objective is achieved by combining instrument-based preparation (manual or mechanical) with antiseptic irrigating solutions followed by three-dimensional obturation of the root canal system. The gold standard irrigant is still sodium hypochlorite, which can be associated with EDTA to offer bactericidal, solvent and chelating actions all in one. The literature reports generally show that regardless of the instrumentation and irrigation techniques, the effectiveness of irrigating solutions remains limited in the apical one third of a prepared canal. This is particularly true for curved root canals and even on single-rooted teeth. Therefore, the improvement of irrigating protocols is essential during root canal treatment in order to achieve better cleaning efficiency especially in the very complex apical area [1].

Currently, several techniques and systems are available and reported to improve final irrigation before obturation. Among these protocols, passive ultrasonic irrigation has shown promising results on debrisand smear layer removal [1].

The EndoActivator (Fig.1) uses sonic energy to irrigate root canal systems. This system has 2 components, a headpiece and activator tips (Yellow 15/02, Red 25/04, Blue 35/04). The battery-operated headpiece activates from 2,000–10,000 cycles/min. The manufacturer recommends using this device after completion of cleaning and shaping and irrigation of the canal with a manual syringe and an endodontic irrigation needle. On placing irrigant into the canal and chamber, passively fitting tips are activated at 10,000 cycles/min for 30–60 seconds. It has been reported that sonic irrigation is capable of producing clean canals [2].

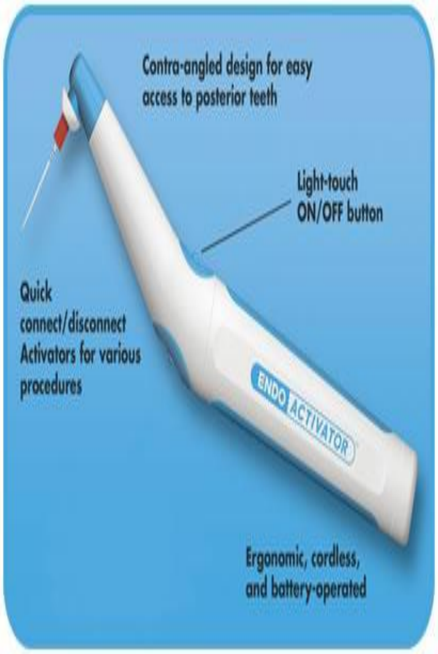


Fig.1: Endoactivator System

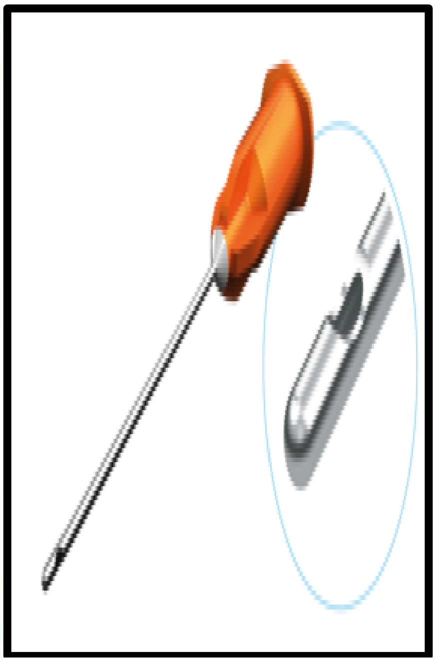


Fig.2: Side Vented Needle

Manual irrigation with a side-vented needle by using positive pressure (Fig. 2) within 2–3 mm of working length is the most commonly used endodontic irrigation system. Instances of expressing irrigants into periapical tissues and causing significant tissue damage and postoperative pain have been reported with the use of positive pressure [2]. In vitro studies have demonstrated that when root canals are instrumented and irrigated with patent apical terminations, extrusion of irrigants beyond the apical constriction is routine. Accordingly, the premise of this study was to create the worst-case scenario for testing the potential of each device to extrude endodontic irrigants: a tooth with a patent apical foramen, not covered by either bone or membrane, and terminating in an atmospheric neutral environment [2]. The purpose of this study was to evaluate the efficacy of Endoactivator in the removal of debris and checking apical extrusion of irrigating solution from root canal walls compared to Conventional Methods.

II. Materials and methods

20 extracted mature human single rooted teeth were cleaned, instrumented with #08K-type file to determine the working length followed till #15K-type file to acquire the patency, ending biomechanical preparation using Protaper rotary file system and irrigated (Fig. 3). Teeth were divided into 2 groups. Group 1 – Conventional irrigation was performed using 2.5% NaOCl and 17% EDTA with side vented needle. Group 2 – final activation of irrigants by Endoactivator.

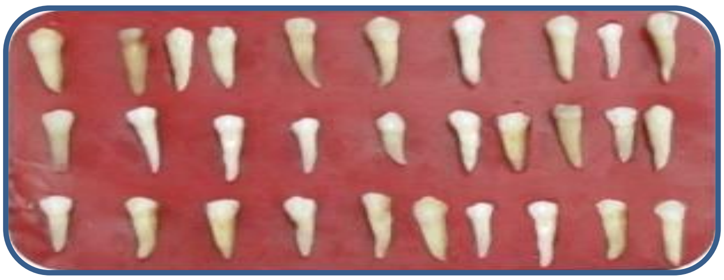


Fig.3:20 single rooted teeth (Group 1-10 teeth Conventional; Group 2- 10 teeth Endoactivator)

Group 1: After suctioning away the intracanal surplus of NaOCl with the 27-gauge needle, 1 ml of 17% EDTA was flushed into each canal and was left in place for 1 minute per canal. All canals were then flushed with 3 ml of 3% sodium hypochlorite, which was left in place for 30 seconds per canal (Fig. 4). **Group 2:** After optimally preparing the canal, surplus NaOCl was suctioned away with the 27-gauge needle. Each canal was then irrigated with 1 ml of 17% EDTA using the 27-gauge needle. This intracanal solution was activated with either a red (25/04) or blue (35/04) EndoActivator tip at a speed of 10 kHz for 1 minute per canal. Each canal was then flushed with 3 ml of 3% sodium hypochlorite.

This solution was then activated using either the red or blue EndoActivator tip for 30 seconds per canal (Fig. 5). The amount of extruded solution was measured by calibrated vial. Roots were sectioned and the apical, middle and cervical thirds were examined by SEM and analyzed.

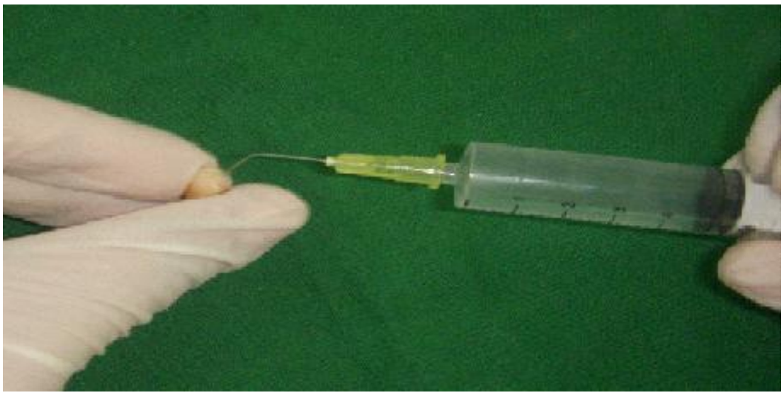


Fig.4: Group 1 – Conventional irrigation was performed using 2.5% NaOCl and 17% EDTA with side vented needle.

Fig.5: Group 2 –Final activation of irrigants by Endoactivator.

2.1 Sectioning of the Teeth and preparation for SEM

The teeth were sectioned in two halves (Fig.6 & Fig.7). Two horizontal grooves were made using a Frios diamond-cutting disk mounted on a surgical dental headpiece. The apical and middle one thirds of the canal were then sectioned in the longitudinal plane with a precision diamond bur. A continuous supply of air was delivered to improve vision and cutting precision, which eliminated the potential of introducing debris into this region of the canal. Each sample was dehydrated in graded series of ethanol solutions, critical point dried, coated with gold, and viewed with a scanning electron microscope at 15 kV.

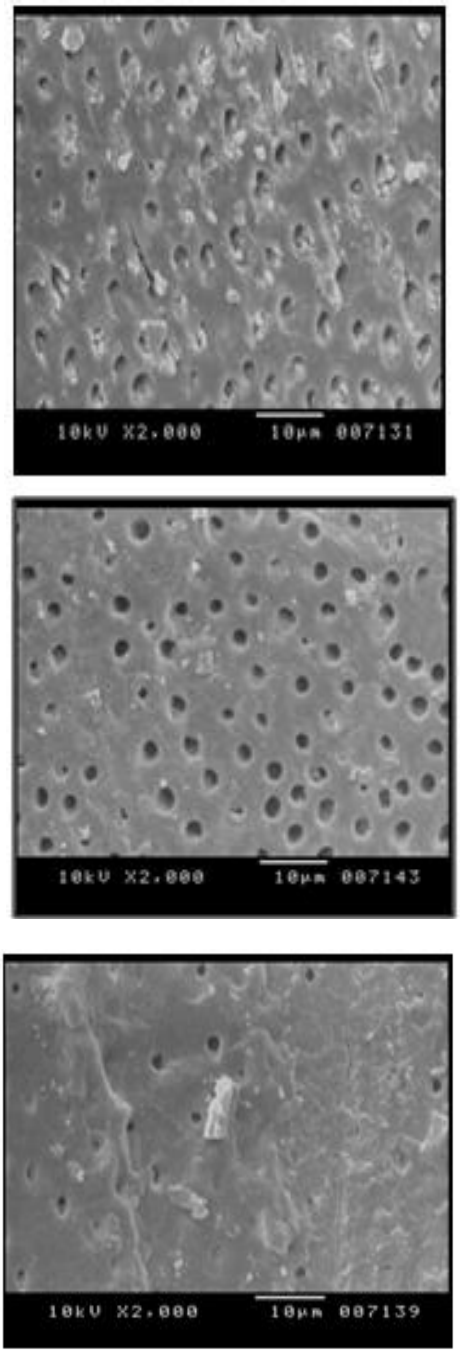
Fig.6: Conventional Irrigation

Fig.7: Endoactivator Irrigation

2.2 SEM Evaluation and Statistical Analysis

Each fragment was first viewed at low magnification (x30) by the operator (GC) and another trained dentist with SEM studies (KN) in order to gain an overview of the sample. Two practitioners with no inside knowledge of the operative procedures blindly assessed the images and who were fully conversant with qualitative analysis on root canal images produced by scanning electron microscopy.

Analysis began using the scale described in Hu'lsmann et al but the significant lack of sensitivity in the best scores prompted us to refine the system, as follows (Fig. 8 & Fig.9): Score 1: No debris, Score 2: Smear layer obliterating dentinal tubule, Score 3: Smear layer covering dentin walls, Score 4: partial covering with a thick smear layer, and score 5: Debris covering dentin walls. Nonparametric data were analyzed by using the Kruskal-Wallis test and the Mann-Whitney rank sum test for pairwise comparisons. The significance level for all statistical analyses was set at a = 0.05. All statistical analyses were performed with the SPSS for Windows 12.0 software package.



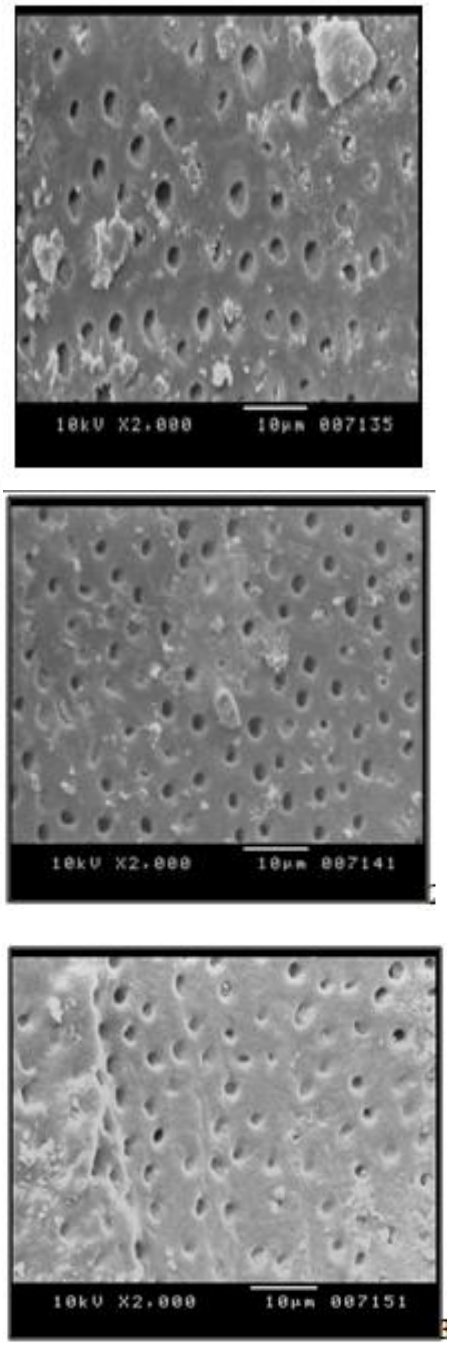


Fig.8: SEM Images – Conventional Irrigation (1-Coronal; 2-Middle; 3-Apical)

Fig.9: SEM Images – Endoactivator Irrigation (1-Coronal; 2-Middle; 3-Apical)

III.Results

After consensus was reached for each group, mean scores for Debris removal in the apical, middle & Coronal third were listed (Table 1).

Table 1: Scores given as per Cleaning Abilities of both the systems in Apical (A), Middle (M) & Coronal (C) third of each Sample

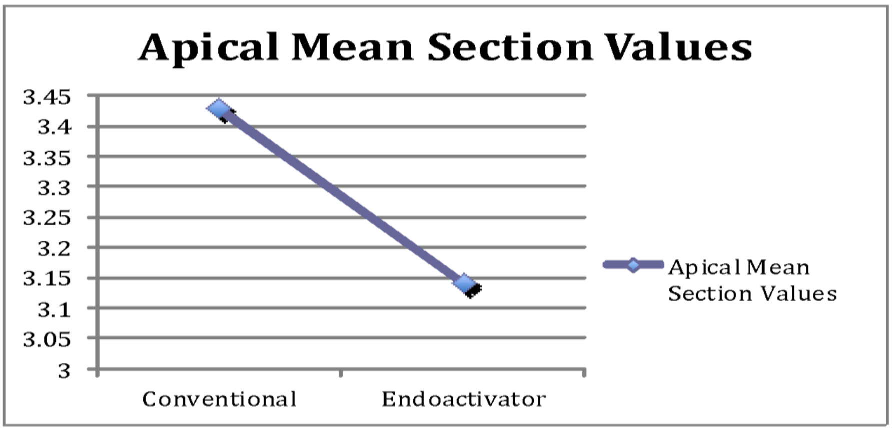
	Conventional Method			Endoactivator System		
Sample	**A**	**M**	**C**	**A**	**M**	**C**
1	4	4	4	3	1	2
2	3	4	3	3	3	1
3	3	2	4	3	1	1
4	3	3	3	4	1	2
5	4	4	3	3	3	1
6	3	2	4	3	1	2
7	4	3	4	3	1	1

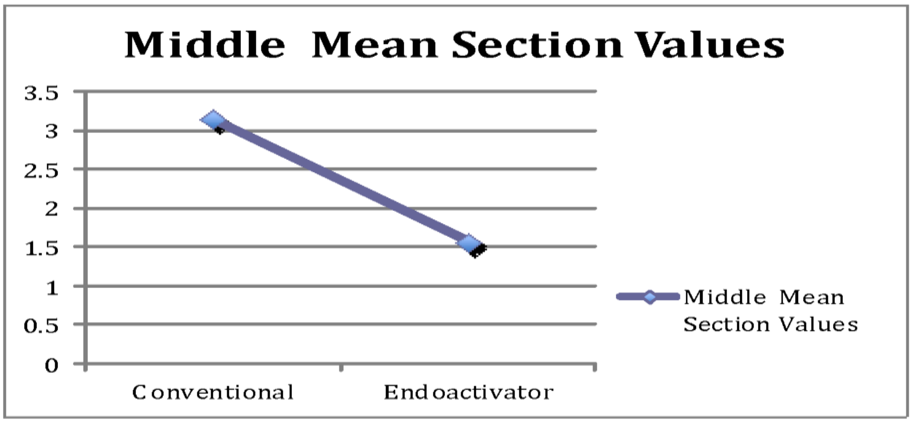
Table 2: Mean (Average) Scores of cleaning abilities of both the systems in Apical (A), Middle (M) & Coronal (C) third

Regions	Conventional	Endoactivator
Apical	3.42	3.14
Middle	3.14	1.57
Coronal	3.57	1.42

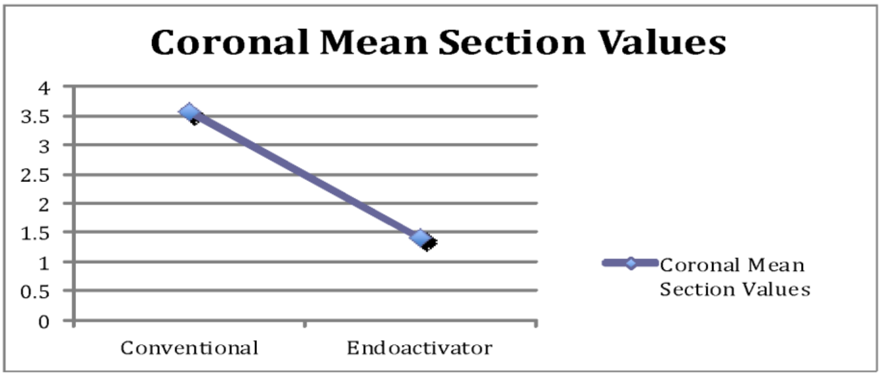
3.1 Plots of Means Section

Graph 1: Apical Mean Section values





Graph 2: Middle Mean Section Values

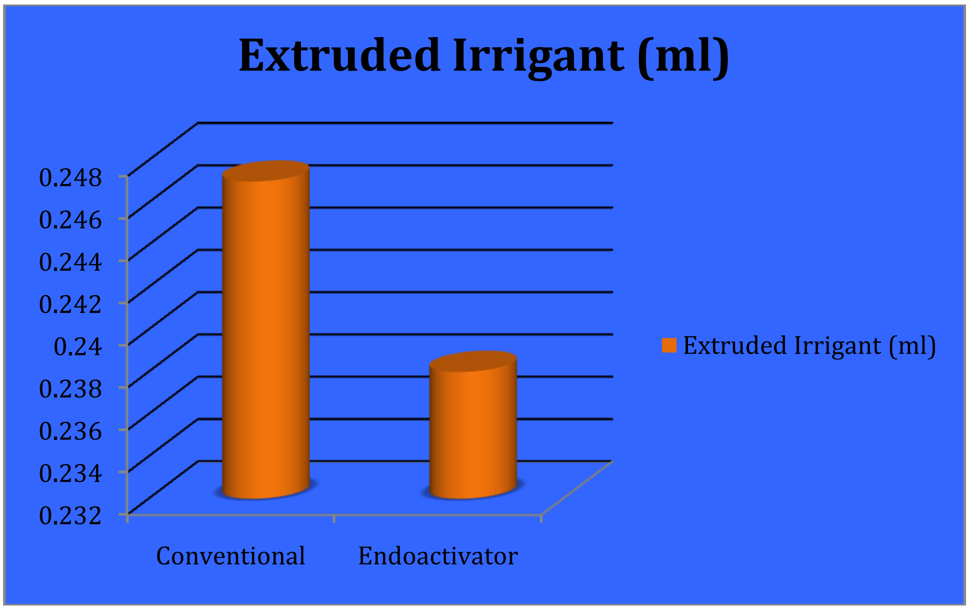


Graph 3: Coronal Mean Section Values

Table 3: Irrigant extruded apically during shaping and cleaning by each system:

	Conventional (n=10)		Endoactivator (n=10)	
	X	SD	X	SD
Extruded Irrigant (ml)	0.247	0.098	0.238	0.020

n- number of samples
X - arithmetic mean of the amount of extruded irrigant
SD – standard deviation



Graph 4: Mean Irrigant Extruded

IV. Discussion

The endodontic community is now unanimous concerning the positive benefit of irrigation during the root canal preparation phase. The chemomechanical preparation should ideally result in a fully cleansed and disinfected root canal system. Literature has shown that apical enlargement and deeper positioning of the irrigation needle are required to clean the apical third [1]. The ability of the irrigant to penetrate into areas not instrumented by mechanical instrumentation is critical for debridement and disinfection of the root canal system. Previous studies have shown that sonic and ultrasonic irrigation, for as little as 30 seconds, resulted in significantly cleaner canals than hand filing alone. Efficient penetration and distribution of the irrigant solutions in uninstrumented areas, represented by the artificially created lateral canals, correlates directly with previous studies that evaluated the efficacy of passive ultrasonic activation of irrigants for debridement, disinfection, and smear layer removal [3].

The protocol for this study was designed to maximize the possibility of irrigant extrusion through an unrestricted, yet normal apex. It is understood that in clinical situations several factors might decrease the extent to which these systems extrude solutions. Periapical tissues and bone provide resistance to apical extrusion as well as non-patent canals [2]. Although Endoactivator extruded irrigant, the volume was very small, and the clinical significance is not known. However, the manufacturer's instructions at the time of research did not suggest the use of manual irrigation before using Endoactivator. In a recent publication by Ruddle, he suggested the use of intracanal irrigation before using EndoActivator [2]. Because the basic goal of successful endodontic therapy is to eradicate microorganisms and other intracanal debris from the root canal system, the clinician must be able to deliver antimicrobial and tissue solvent solutions in predictable volumes safely to full working length. This goal seems to have been accomplished by using the Endoactivator system in terms of safety (no apical extrusion) [2].

V.Conclusion

This study concluded that the EndoActivator had a minimal, although statistically insignificant, amount of irrigant extruded out of the apex when delivering irrigant into the pulp chamber, placing the tip into the canal, and initiating the sonic energy of the Endoactivator. Conventional Side Vented needle group had significantly greater amounts of extrusion compared to Endoactivator group.

References

[1]. Gregory Caron, Khan Nham et al. Effectiveness of Different Final Irrigant Activation Protocols on Smear Layer Removal in Curved Canals. Journal Of Endodontic. 2010 August; 36(8): 1361-1366.

[2]. Pranav Desai, BDS, DDS, and Van Himel, Comparative Safety of Various Intracanal Irrigation Systems. Journal Of Endodontic. 2009 April; 35(4): 545-549.

[3]. Cesar de Gregorio, Roberto Estevez et al. Effect of EDTA, Sonic, and Ultrasonic Activation on the Penetration of Sodium Hypochlorite into Simulated Lateral Canals: An In Vitro Study. Journal Of Endodontic.2009 June; 35(6): 891-895.

*Dr.Sneha Vaidya. "Efficacy of Endoactivator Irrigation System for Debris Removal And Checking Apical Extrusion of Irrigating Solution Compared To Conventional Methods – A SEM Evaluation." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 16.11 (2017): 75-81