

## Comparison of Apical Third Cleanliness of Smear Layer Using Endoactivator® and Vibringe®

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### Abstract

Root canal preparation will form a smear layer that may prevent root canal filling material penetration into the dentinal tubules at the apical third of the root canal. Irrigation of the root canal system permits removal of residual tissue needs proper irrigation techniques and material. This study obtain data over smear layer cleanliness in the apical third that irrigated with two sonic irrigation techniques.

Thirty permanent premolars were divided into three groups. Group E were using Endoactivator® techniques. Group V were using Vibringe®, and K as the manual control group. Those three irrigation technique were examined using SEM in all groups. Débridement efficacies were analysed Kolmogorov – Smirnov and give results : There was no significant difference between groups E and V (  $p = 0.059$  )

Both types of sonic irrigation techniques showed no statistically significant differences. Descriptively, Endoactivator® sonic irrigation techniques gives better result than Vibringe® and manual controls.

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### Introduction

The main purpose of root canal treatment is to eliminate microorganisms and their toxins present in the root canal and reinfection does not arise after the treatment done. Root canal preparation will form a smear layer that are stacked on the apical third of the root canal and found difficult to clean. That could be removed with combination of techniques and appropriate irrigation during the preparation procedure.<sup>1-6</sup>

Currently the widely used in irrigation are using needle size 27G or 30G with a passive technique, more irrigation techniques being developed in combination with proper irrigation material to have better result that will be more effective and efficient in dissolving organic and inorganic components, eliminate bacteria and

smear layer. Sonic irrigation techniques is using tools that emit sonic vibrations, to increase the penetration of irrigation channel through hydrodynamic effects. Currently there are two sonic irrigation techniques. The first, the irrigation fluid inside the root canal vibrated by a needle mounted on a vibrating sonic namely Endoactivator® and the second material is vibrated in the irrigation syringe and irrigated into the root canal through a resonate needle, which is Vibringe®. Until now there has been no study that shows differences in these two tools in cleaning the smear layer, so this study was to compare the effectiveness of these two techniques.<sup>2,5,7-12</sup>

### Materials and methods

The materials used are 30 human extracted teeth, lower premolar with single root canal, paper point 6% taper, EDTA gel (RC Prep), NaOCl 2.5%, 17% liquid EDTA (MD Cleanser ), NaCl 0.9%, Dyes precious metals platinum, Silica Gel, and Auto fine coater. The tools used are Dental loupe with 3x magnification, stainless steel K File No. 8, 10, 15 Maillefer (Dentsply), Set

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rotary NiTi files non-ISO (Revo-S, Micromega), endodontic rotary instruments (X-Smart, Dentply), Machine Endoactivator® irrigation and irrigation tip (Dentsply), irrigation machine Vibringe® (Cavex), irrigation needle No. 30, and Scanning Electron Microscope (SEM).

All specimens were cleaned with a scaler, then soaked in a solution of NaCl to be done root canal preparation. Lower premolar tooth specimens that have been extracted prepared with round diamond burr obtain straight access. Samples were randomized and divided into 3 groups: E, V and K. Both groups prepared with crown-down technique using Revo-S files. Group E irrigated with irrigation tool Endoactivator® and V irrigated with irrigation tool Vibringe®. Working length specified ± 0.5 mm of the apical foramen.

The root canal were irrigated using Endoactivator® with 2.5% NaOCl 2.5 ml each. After preparation completed, all of the root canals irrigated with 17% EDTA solution for 30 seconds, then rinsed with NaOCl 2,5% 2,5 ml for 30 seconds, and dried with paper points and cut with a cutting instrument is then split vertically into two parts buccal lingual direction using a diamond bur and high speed handpiece to facilitate cutting using a chisel after instrumentation and irrigation.

Prepared tooth were irrigated with Vibringe® using a solution of 2.5 ml of 2.5% NaOCl every turn of the tool. After preparation completed, the root canals irrigated with 17% EDTA solution for 30 seconds, then rinsed with NaOCl 2,5% 2,5 ml for 30 seconds, and dried with paper points, the specimens into two parts of the buccal lingual using a diamond bur and high speed handpiece and to facilitate cutting were using a chisel after instrumentation and irrigation.

After that the specimen were divided into 3 more partsto have the apical third area for SEM examination (Figure 1).

**Scoring system**

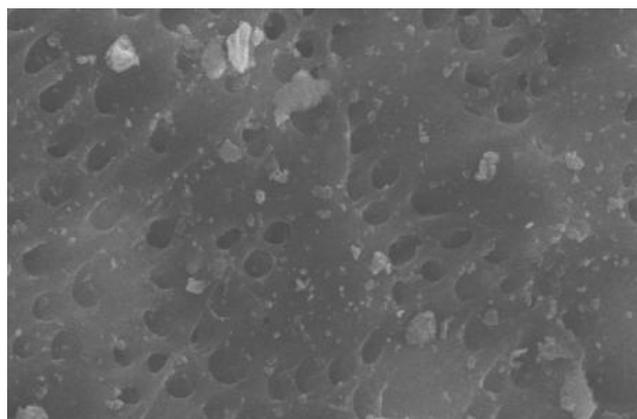
Score 0: if > 75% apical third clean of smear layer;

Score 1: if 50% -75% apical third clean of smear layer

Score 2: if <50% apical third clean of smear layer.

**Statistical analysis**

The data obtained in numerical form will then be analyzed statistically using non parametric statistical tests *Chi-Square and Kolmogorov Smirnov* with significance level ( $p < 0.05$ ).



**Figure 1.** Scanning Electron Microscope of score 0 in Endoactivator.

**Results**

Results will be presented in analytical form. Observation results conducted by two observers, each observer reliability and validity have been tested and have been qualified the Kappa is 0.94 (94.9%) more than 80%, which indicates the agreement of both the observer is good. Distribution of hygiene scores smear layer of root canal walls at the apex of the third area is seen from the percentages presented in Table 1.

Table 1 shows the percentage score 0 of Endoactivator® 13.3% greater in value than Vibringe® by 10%. Score 1 of Endoactivator® 20% greater in value than Vibringe® of 16.7%. Score 2 of Endoactivator® shows the percentage of 0% and in Vibringe® 6.7%.

Group	Cleanliness score of <i>Smear layer</i> on apical third			
	n	0 %	1 %	2 %
Endoactivator®	10	13,3	20	0
Vibringe®	10	10	16,7	6,7
Manual	10	6,7	6,7	26,7
Total	30	30	43,3	26,7

\* Crosstab Group of apical third cleanliness

**Table 1\*.** Smear Layer Score Distribution after irrigated with Endoactivator®,Vibringe®, and manual.

Group 1	Group 2	p*
Endoactivator®	Vibringe®	0,987
Endoactivator®	Manual (Control)	0,055
Vibringe®	Manual (Control)	0,400

**Table 2.** ValueGrup Endoactivator, Vibringe, Manual Control.

Manual control shows more result of score 2 which are less than 50% apical third clean of smear layer means manual control which used widely as an irrigation techniques doesn't seem to be enough to clean the smear layer. We might need sonic irrigation technique to achieve better result in cleaning the smear layer.

Table 2. shows the significance between groups Endoactivator® with Vibringe® was 0.987 ( $p < 0.05$ ) so that the statistics do not show a significant differences. In the group Endoactivator® with Manual control group was 0.055 with a significance value ( $p < 0.05$ ) so that the group was also not significantly different. In the group Vibringe® with Manual control group  $p = 0.400$  ( $p < 0.05$ ) so that the group was also not significantly different.

## Discussion

Irrigation is very important in root canal preparation. Apical third of the area tends to be more difficult to clean because of the anatomical shape which is narrower and far from the coronal so it is important to bring irrigation material to get to the apical third. Irrigation material must have the properties of lubricants, antimicrobial, and capable of removing organic and inorganic debris and biocompatible.<sup>9-12</sup>

Root canal preparation will form small particles of debris, collagen matrix and will spread along the area called the smear layer. The instrument used was Revo-S because it has fewer sequences as to accelerate the preparation process. These files are designed to have a light contact with the root canal so that the pressure on the root canal is not too large, thereby reducing the fracture risk.<sup>3,14,15,28</sup>

Irrigation materials used in this case were NaOCl 2.5% and EDTA 17%. NaOCl commonly used in irrigation because of the antimicrobial effect and could dissolve the organic tissue. EDTA is effective in dissolving inorganic material and chelate the calcium so it will be effective in the dentin demineralization.<sup>16-19</sup>

The analysis results obtained value of significance ( $p$ ) between the groups Endoactivator® and Vibringe® with  $p = 0.98$  ( $p > 0.05$ ). Results of the analysis showed sonic irrigation techniques Endoactivator® groups did not differ significantly by Vibringe® in the cleanliness level of the root canal at the apical third area. The state did not differ significantly

perhaps because it has a fluid movement and hydrodynamic as well.<sup>11,14</sup>

In the percentage of cleanliness of the area in the apical third of the group is better than the group Endoactivator® Vibringe® which is likely due to differences that hidrodinamikanya greater frequency in the group Endoactivator®. In the sonic irrigation techniques such as Endoactivator® can generate oscillations with a combination of up and down movement so that action not only in the vertical direction but also the horizontal direction. Frequency of tool Endoactivator® can cause fluid hydrodynamic optimal irrigation. This might be operated 10.000 cycle per minute has been shown to optimize debridement and promote disruption of the smear layer and biofilm. The greater the frequency the greater the vibration and dynamics of materials in root canal irrigation so that the penetration of the material to the walls of the root canal will also increase. Endoactivator® tool has a frequency of 1000-6000 Hz, while Vibringe® 150 Hz, high and low frequency difference affects the cleanliness of the root canal of the smear layer. Results of overall score showed that sonic irrigation techniques Endoactivator® slightly better than Vibringe® techniques but the results were not statistically significant differences.<sup>9,20,21,26-28</sup>

## Conclusions

Endoactivator®, Vibringe® and passive manual could clean the root canal from the smear layer on the apical third. However, manual techniques are much less cleaning effect than Endoactivator® and Vibringe®. Endoactivator® is a better techniques in cleaning the smear layer at the apical third compared to Vibringe®.

## Declaration of Interest

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## References

1. Ingle JI, Himel VT, Hawrish CE, Glickman GN, Serene T, Rosenberg PA. *Endodontic Cavity Preparation* in: Bakland LK, Ingle JI (ed). *Endodontics 5<sup>th</sup> ed*. New Delhi: Elsevier. 2004;470, 499
2. Walton RE, Rivera EM. *Cleaning and Shaping* in: Torabinejad, M, RE Walton (Ed). *Principles and Practices of Endodontics 3<sup>rd</sup> edition*. Philadelphia: WB Saunders Co. 2002;207-209.

3. Gu LS, Kim JR, Ling J, Choi KK, Pashley DH, Tay FR. *Review of Contemporary Bahan irigasit Agitation Techniques and Devices*. J Endod. 2009;35(6):791-804.
4. Decker Inc; 2008:877–991. Glassman G. *Safety and Efficacy Considerations in Endodontic Irrigation*. [www.ineedce.com](http://www.ineedce.com). 2011.
5. Nair PN, Henry S, Cano V, Vera J. *Microbial Status of Apical Root Canal System of Human Mandibular First Molars with Primary Apical Periodontitis after "One-Visit" Endodontic Treatment*. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005;99:231-52.
6. Peters OA, Koka RS. Preparation of coronal and radicular spaces. In: Ingle JI, Bakland LK, Baumgartner JC, eds. *Endodontics*. 6th ed. Hamilton: Canada: BC.
7. Akbar, Soerono SM. *Endodontologi Kumpulan Naskah*. Jakarta: Hafidz. 2003;40,155-63.
8. Peters OA. *Current challenges and concepts in the preparation of root canal systems: a review*. J Endod 2004;30:559–67.
9. Elumalai D, Kumar A, Tewari RK, et al. *Newer Endodontic irrigation devices: An update*. IOSR- JDMS 2014; 13:4-8.
10. Sahbaz C, Adiquzef O. *An Evaluation of Efficiency of Different Irrigation Systems on the Smear layer*. J International Dental and Research 2014,1:14-20.
11. Lee SJ, Wu MK, Wesselink PR. *The effectiveness of syringe irrigation and ultrasonics to remove debris from simulated irregularities within prepared root canal walls*. Int Endod J 2004;37:672–8.
12. Jiang LM, Verhaagen B, Versluis M, van der Sluis LW. *Evaluation of a sonic device designed to activate irrigant in the root canal*. J Endod 2010;36:143–6
13. Cheung GS, Stock CJ. *In vitro cleaning ability of root canal irrigants with and without endosonics*. Int Endod J 1993;26:334–43
14. Caron G. *Cleaning efficiency of the apical millimeters of curved canals using three different modalities of irrigant activation: an SEM Study*, Master Thesis Part 1 and 2, Paris 7 University (Paris, France), 2006.
15. Siqueira JF Jr., Rocas IN. *Clinical implications and microbiology of bacterial persistence after treatment procedures*. J Endod 2008;34:1291–301.
16. Sundqvist G, Figdor D, Persson S, Sjogren U. *Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment*. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998;85:86–93.
17. Gu LS, Kim JR, Ling J, Choi KK, Pashley DH, Tay FR. *Review of contemporary irrigant agitation techniques and devices*. J Endod 2009;35:791–804.
18. Schoeffel GJ. *The EndoVac method of endodontic irrigation, part 2: efficacy*. Dent Today 2008;27:82–7.
19. van der Sluis LW, Versluis M, Wu MK, Wesselink PR. *Passive ultrasonic irrigation of the root canal: a review of the literature*. Int Endod J 2007;40:415–26
20. International Academy for Rotary Endodontics, *Endodontic Obturation*, [http://www.healthmantra.com/rotary/endodontic\\_obturation.shtml](http://www.healthmantra.com/rotary/endodontic_obturation.shtml). (Download 5 April 2011).
21. Hammad M, Qualtrough A, Silikas N, *Evaluation of Root Canal Obturation: A Three-dimensional in Vitro Study*. J Endod. 2009;1-4.
22. Ingle JI, Simon JH, Machtou P, Bogaerts P, *Outcome of Endodontic Treatment and Re-treatment* In: Ingle JI, Bakland LK (editor), *Endodontics 5<sup>th</sup> ed*. Ontario: Elsevier, 2002;748-786.
23. Ruddle CJ. *Cleaning and Shaping the Root Canal System*. In: Cohen S BR, editor. *Pathways of the Pulp 8th ed*. St. Louis: Mosby, Inc; 2002;231-91.
24. Holliday R, Alani A. *Traditional and Contemporary Tehnnique for Optimizing Root Canal Irrigation*. Dental Update 2014;41:51-61.
25. Haapsalo M, Shen Y, Wang Z, Gao Y. *Irrigation in endodonrics*. British Dental Journal 2014;261:299-303.
26. E. Karataş, D. Ozsu. *Comparison of the Effect of Nonactivated Self-Adjusting File system, Vibringe, Endovac, Ultrasonic and Needle Irrigation on Apical Extrusion of Debris*. International Endodontic Journal. 2015 April; 48(4):317-22.
27. Jordan A Bolles, Jianing He. *Comparison of Vibringe, EndoActivator, and Needle Irrigation on Sealer Penetration in Extracted Human Teeth*. Journal of endodontics 2013;34 39(5):708-11.
28. AysinDumani, HaticeKorkmazGüvenmez. *Antibacterial Efficacy of Calcium Hypochlorite with Vibringe Sonic Irrigation System on Enterococcus faecalis: An In Vitro Study*. BioMed Research International Volume 2016.