

Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com

doi: 10.21276/jamdsr

UGC approved journal no. 63854

(e) ISSN Online: 2321-9599;

(p) ISSN Print: 2348-6805

Original Article

In vitro Evaluation of Sealing Ability and Marginal Adaptation of Different Root canal Sealers

Anupama Ahirwar¹, Deesha Kumari², Aditi Chohan³, Shilpa M⁴

¹Senior Resident, Gandhi Medical College, Bhopal, Madhya Pradesh, India,

^{2,4}Senior lecturer, Department of Public Health Dentistry, A.B. Shetty Memorial Institute of Dental Sciences, Nitte

(Deemed to be) University, Deralakatte, Mangaluru, India, ⁴Consultant dental surgeon, Bhopal, Madhya Pradesh, India

ABSTRACT:

Background: The purpose of root canal treatment is to maintain a tooth free of infection. In order to achieve successful treatment, the use of materials and techniques capable of providing a fluid tight seal from the apical part of the canal to the coronal margin in order to prevent reinfection. So the present study was conducted with an aim to evaluate the sealing ability and marginal adaptation of different root canal sealers. **Materials and Method:** Sixty extracted mature human mandibular premolars were used in this study. The teeth were cleaned of debris and soft tissue remnants and were stored in saline solution. Canal preparation was done and teeth were randomly divided into 3 experimental groups (n=20). Group 1: EndoRez, sealer, Group 2: Conventional zinc oxide eugenol (ZOE) sealer, Group 3: AH Plus sealer. A hard tissue microtome was used to section the samples vertically. Coronal and apical halves of root canal was viewed under scanning electron microscope. **Results:** Maximum Marginal adaptation was shown by AH plus sealer (5.12 ± 0.08) followed by the EndoRez sealer (2.50 ± 0.42) and Conventional zinc oxide eugenol (ZOE) sealer (1.20 ± 0.10). There was a statistically significant difference ($p=0.001$) between the coronal and apical marginal adaptation with AH Plus sealer followed by EndoRez sealer ($p=0.05$). But Conventional zinc oxide eugenol (ZOE) sealer did not show any significant difference between the coronal and apical marginal adaptation. **Conclusion:** On conclusion, AH Plus sealers showed significantly better marginal adaptation and has got better sealing ability compared to Endorez and conventional zinc oxide eugenol (ZOE).

Keywords: AH Plus, Endorez, sealers, zinc oxide eugenol

Received: 8 February, 2019

Revised: 27 February, 2019

Accepted: 28 February, 2019

Corresponding Author: Dr. Anupama Ahirwar, Senior Resident, Gandhi Medical College, Bhopal, Madhya Pradesh, India,

This article may be cited as: Ahirwar A, Kumari D, Chohan A, M Shilpa. In vitro Evaluation of Sealing Ability and Marginal Adaptation of Different Root canal Sealers. J Adv Med Dent Scie Res 2019;7(3): 112-115.

INTRODUCTION:

A complete three dimensional impervious obturation of the root canal system is of prime clinical importance for the long-term success of endodontic treatment. although a number of materials are used for obturation, the most common material is combination of gutta-percha cones and sealer. As gutta-percha does not bond to root canal walls, the use of sealers along with well adapted gutta-percha has been recommended.¹

Incomplete obturation of the root canal accounts for 58% of endodontic failures. The incomplete obturation may be because of incomplete instrumentation or improper obturation technique. The sealers used should fill the discrepancies between the canal wall and the gutta-percha; act as a lubricant and aid in seating the gutta-percha cones. The sealers should also fill the patent accessory and lateral canals, entomb the bacteria present within the dentinal tubule and allow for the repair of the periapical tissue.²

Previously too much unnecessary emphasis has been placed on whether the filling has reached the radiographic apex or not. Three-dimensional obturation of root canal is important for ensuring the long term success of RCT. Except for coronal and apical microleakage, the microgap between sealer and the root canal wall as well as its tubule penetration depth is also a key factor associated with the clinical outcome of RCT. Good adaptations between sealer and root canal wall can not only reduce the chance of microleakage, but also increase the breaking strength of root canal significantly.^{3,4}

A root canal sealer which only helps in achieving a good hermetic seal but also has antibacterial property and would provide deposition of calcified tissue, and protection against root fracture would be considered as ideal.⁵ Thus, this study was undertaken to evaluate the sealing ability and marginal adaptation of different root canal sealers.

MATERIALS AND METHODS:

Sixty extracted mature human mandibular premolars were used in this study. The teeth were cleaned of debris and soft tissue remnants and were stored in saline solution. All the samples were sectioned at the cemento-enamel junction with a low-speed diamond disc.

Preparation of canal:

A step back technique and stainless steel K-type file was used to prepare root canals manually. No.30 K-file was used as the master apical file and for coronal flaring Gates Glidden drills no. 2 through 4 was used. 5.25% sodium hypochlorite solution, 17% ethylene diamine tetra acetic acid (EDTA) was used to irrigate the canals in between the files, later rinsed with distilled water and sterile paper points for drying.

After completion of the instrumentation, the teeth were randomly divided into 3 experimental groups (n=20).

Group 1: EndoRez, sealer

Group 2: Conventional zinc oxide eugenol (ZOE) sealer

Group 3: AH Plus sealer

Assessment of Marginal adaptation:

These teeth were stored for 10 days at 37°C in a humidifier. A hard tissue microtome was used to section the samples vertically this reduces the chances of crack formation in the tooth structure and also the material. Coronal and apical halves of root canal was viewed under scanning electron microscope and also marginal gap at sealer and root dentin interface was evaluated.

Statistical analysis:

The statistical analysis was done using SPSS version 20. Kruskal-Wallis analysis of variance was used. P < 0.05 was considered as statistically significant.

RESULTS:

Table 1 & Graph 1 show the mean and standard deviation of three sealers. Maximum Marginal adaptation was shown by AH plus sealer (5.12± 0.08) followed by the EndoRez sealer (2.50 ± 0.42) and Conventional zinc oxide eugenol (ZOE) sealer (1.20± 0.10).

Marginal adaptation of three sealers at coronal and apical levels shown in table 2. There was a statistically significant difference (p=0.001) between the coronal and apical marginal adaptation with AH Plus sealer followed by EndoRez sealer (p=0.05). But Conventional zinc oxide eugenol (ZOE) sealer did not show any significant difference between the coronal and apical marginal adaptation.

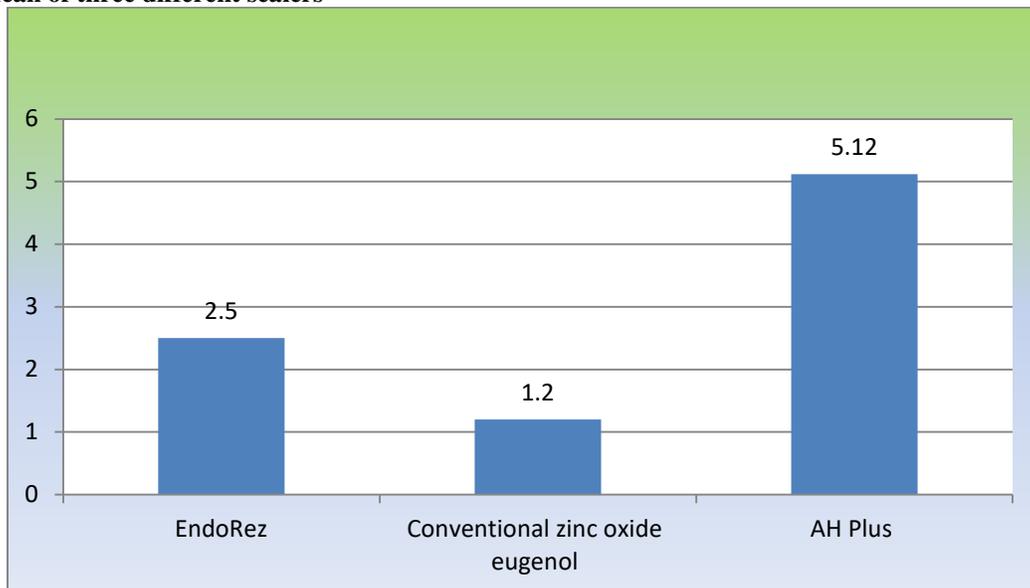
Table 1: Mean and standard deviation of three different sealers

Groups	n	Mean± Std. Deviation
Group 1: EndoRez, sealer	20	2.50 ± 0.42
Group 2: Conventional zinc oxide eugenol (ZOE) sealer	20	1.20± 0.10
Group 3: AH Plus sealer	20	5.12± 0.08

Table 2: Marginal adaptation of three sealers at Coronal and Apical levels

Type of sealer	Coronal (Mean ± SD)	Apical (Mean ± SD)	K ANOVA Value	P value
EndoRez, sealer	0.52± 0.12	1.98± 0.30	23.00	0.05
Conventional zinc oxide eugenol (ZOE) sealer	0.40± 0.08	0.80± 0.02	24.12	0.140
AH Plus sealer	1.86± 0.02	3.26± 0.06	21.68	0.001

Graph 1: Mean of three different sealers



DISCUSSION:

The main aim of the obturation is to provide a three dimensional seal, thereby it prevents the reinfection of root canal and preserving the health of periapical tissues. Obturation with Gutta-percha along with sealer is considered to be gold standard in root canal therapy. In spite of its various advantages, it has fewer demerits like its inability to bond with root canal dentin and also due to the hydrophobic nature the sealer tends to pull away from the Gutta-percha on setting.⁶

The present was conducted to assess both coronal as well as the apical marginal adaptation of the sealers. Because of coronal leakage of the root canal filled tooth is considered to be an important cause in the failure of the root canal treatment. There have been numerous dye leakage, bacterial penetration, and fluid filtration leakage studies that have evaluated coronal leakage. Several studies have shown that root canal fillings are susceptible to leakage when contaminated coronally by artificial saliva and microorganisms.^{7,8}

In the present study AH plus sealer turns out to be better among the three in marginal adaptation and sealing capacity. The reasons being radiopacity, biocompatibility, ease to use and availability. Composition of AH Plus is an epoxy-bis-phenol resin based sealer and contains adamantine to bond to root canal.⁹

Ruddle CJ et al¹⁰ in his study he said that even though AH Plus sets faster but it tends to shrink and cause early debonding from the root canal wall. As AH Plus is an epoxy resin-based sealer, penetrates better into the micro-irregularities than others and also increases the mechanical interlocking between sealer and root dentin because of its creep capacity and long setting time thus Pawar SS et al¹¹ concluded that AH plus has greater adhesion to root dentin than other sealers.

The hydrophilic nature of the sealer along with ability of Endorez to form long resin tags with thin hybrid layer may account for their superior sealing ability.¹² Gillespie et al¹³., showed that the sealing ability of Endorez can be improved by using adhesive-modified Endorez filling technique. De-Deus G et al¹⁴., reported less bacterial leakage at nine weeks for Endorez when used in thin layers compared with AH Plus and Sealapex, but the same was not seen when used in thicker layers. The present study results is in agreement with Zmener O et al¹⁵., who demonstrated better apical sealing when sealer was used on moist root canal dentin and found AH Plus to have better sealing ability than Endorez and conventional zinc oxide eugenol (ZOE) sealer. Further studies with a larger sample size along with clinical trials, in different canal configuration are needed to evaluate the sealing ability of these sealers.

CONCLUSION:

On conclusion, AH Plus sealers showed significantly better marginal adaptation and has got better sealing ability compared to Endorez and conventional zinc oxide eugenol (ZOE).

REFERENCES:

1. Gutmann JL. Clinical radiographic and histologic perspectives on success and failure in endodontics. *DCNA*. 1992; 36: 379-92.
2. Ballullaya SV, Vinay V, Thumu J, Devalla S, Bollu IP, Balla S. Stereomicroscopic Dye Leakage Measurement of Six Different Root Canal Sealers. *J Clin Diagn Res*. 2017 Jun;11(6):ZC65-ZC68.
3. Huan Chen, Xinyuan Zhao, Yu Qiu,4 Dengyou Xu, Li Cui, and Buling Wu. The Tubular Penetration Depth and Adaption of Four Sealers: A Scanning Electron Microscopic Study. *BioMed Research International* 2017:1- 8.

4. M.A. Marciano, B. M. Guimaraes, R. Ordinola-Zapata et al. Physical properties and interfacial adaptation of three epoxy resin-based sealers, *Journal of Endodontics* 2011; 37(10):1417–1421.
5. Phukan AH, Mathur S, Sandhu M, Sachdev V. The effect of different root canal sealers on the fracture resistance of endodontically treated teeth-*in vitro* study. *Dent Res J* 2017;14:382-8.
6. Polineni S, Bolla N, Mandava P, Vemuri S, Mallela M, Gandham VM. Marginal adaptation of newer root canal sealers to dentin: A SEM study. *J Conserv Dent* 2016;19:360-3.
7. Madison S, Wilcox LR. An evaluation of coronal micro leakage in endodontically treated teeth. Part III. *In vivo* study. *J Endod.* 1988; 14: 455-8.
8. Torabinejad M, Ung B, Kettering JD. *In vitro* bacterial penetration of coronally unsealed endodontically treated teeth. *J Endod.* 1990; 16: 566-9.
9. Zhang W, Li Z, Peng B. *Ex vivo* cytotoxicity of a new calcium silicate-based canal filling material. *IntEndod J.* 2010;43:769–74.
10. Ruddle CJ. *Advanced Endodontics. Gauging the Terminus: A Novel Method.* [Last accessed on 2012 May 25]. Available from: <http://www.endoruddle.com/blogs/show/21>
11. Pawar SS, Pujar MA, Makandar SD. Evaluation of the apical sealing ability of bioceramic sealer, AH plus & epiphany: An *in vitro* study. *J Conserv Dent* 2014;17:579-82.
12. Sagsen B, Er O, Kahraman Y, Orucoglu H. Evaluation of microleakage of roots filled with different techniques with a computerized fluid filtration technique. *J Endod.* 2006;32:1168–70.
13. Gillespie WT, Loushine RJ, Weller RN, Mazzoni A, Doyle MD, Waller JL, et al. Improving the performance of EndoREZ root canal sealer with a dual-cured two-step self-etch adhesive. II. Apical and coronal seal. *J Endod.* 2006;32:771-75.
14. De-Deus G, Coutinho-Filho T, Reis C, Murad C, Paciornik S. Polymicrobial leakage [32] of four root canal sealers at two different thicknesses. *J Endod.* 2006;32:998- 1001.
15. Zmener O, Pameijer CH, Serrano SA, Vidueira M, Macchi RL. Significance of moist root canal dentin with the use of methacrylate-based endodontic sealers: an *in vitro* coronal dye leakage study. *J Endod.* 2008;34:76-79.