

A Spectro Photometric Comparative Evaluation of Apical Sealing Ability of Three Different Sealers; Calcium Hydroxide Based, Resin Based and Zinc Oxide Eugenol Based Sealers

Vikram Shetty¹, Prashant Hegde², Rashmi Singh Chauhan³, Vishwajit Rampratap Chaurasia⁴, Akanksha Manmohan Sharma⁵, M Taranath⁶

Contributors:

¹Associate Professor and Head, Department of Conservative Dentistry and Endodontics, Faculty of Dentistry, Melaka Manipal Medical College, Melaka, Malaysia; ²Professor & Head, Department of Oral & Maxillofacial Surgery, AME Dental College, Raichur, Karnataka, India; ³Senior Lecturer, Department of Pedodontics, Sinhgad Dental College & Hospital, Pune, Maharashtra, India; ⁴Post Graduate Student, Department Conservative Dentistry & Endodontics, KLE's Dental College, Belgaum, Karnataka, India; ⁵BDS Student, KLE'S Dental College, Belgaum, Karnataka, India; ⁶Senior Lecturer, Department of Preventive & Community Dentistry, Ultra Best Dental College, Madurai, Tamil Nadu, India.

Correspondence:

Dr. Shetty V. Department of Conservative Dentistry and Endodontics, Faculty of Dentistry, Melaka Manipal Medical College, Melaka, Malaysia. Email: kvikramshetty@gmail.com

How to cite the article:

Shetty V, Hegde P, Chauhan RS, Chaurasia VR, Sharma AM, Taranath M. A spectro photometric comparative evaluation of apical sealing ability of three different sealers; calcium hydroxide based, resin based and zinc oxide eugenol based sealers. J Int Oral Health 2015;7(2):25-27.

Abstract:

Background: The aim of this study was to quantitatively analyze the amount of dye leakage with AH26, Sealapex and Tubliseal sealers in endodontically treated teeth.

Materials and Methods: A total of 36 extracted mandibular molar specimens were divided into three groups; Group I: Sealapex, Group II: Tubliseal, Group II: AH26 with 12 samples in each group. Standard access cavity and biomechanical preparation was done with step back flare technique. Obturations were done using respective sealers in the three different groups. Then, samples were subjected to spectro photometric analysis using a filter of 670 nm. Spectrophotometric analysis was performed to quantitatively analyze the amount of dye leakage with all three sealers.

Results: Tubliseal exhibited the least microleakage. In comparison to Sealapex, Tubliseal showed a significant difference. Compared to Sealapex, AH26 showed no significant difference. Comparisons made between Tubliseal and AH26 showed no significant difference.

Conclusion: In the present study, Tubliseal sealer showed least microleakage compared with Sealapex and AH26 sealer.

Key Words: AH26, Calcium hydroxide, Dye leakage, Sealer, Spectrophotometric analysis, Tubliseal

Introduction

Microleakage between the root canal filling and root-canal walls may adversely affects the results of root-canal treatment.¹

Apical leakage is considered to be common cause of endodontic failure.² Hence, different endodontic filling materials, sealers and techniques have been introduced to the dental community in an attempt to improve apical seal.¹ Various materials have been used in root canal treatment in an attempt to achieve success. But, a combination of Gutta-percha and a sealer are used most commonly. Gutta-percha is considered an impermeable core material; therefore, leakage through an obturated root canal is expected to take place at the interfaces between the sealer and dentin or the sealer and gutta-percha, or through voids within the sealer.³ Apical sealing is desirable to prevent passage of bacteria and their endotoxin apically. *In vitro* evaluation of apical dye penetration is used to estimate the sealing ability which is corresponding to *in vivo* amount of micro leakage with particular sealer.² Many techniques were used to evaluate the leakage of sealers such as; colored dye penetration radio labeled tracer penetration dissolution of hard tissue clearing of teeth, spectrometry of radioisotopes electrochemical and gas chromatography. However, many studies showed no significant difference between these techniques.¹

The aim of this *in vitro* study was to quantitatively evaluate the sealing properties of three different root-canal sealers; Tubliseal, Sealapex and AH26 using a spectrophotometric method.

Materials and Methods

Thirty-six extracted sound mandibular molar natural teeth specimens with complete root and free from caries or cracks were collected, stored, disinfected and handled as per the recommendations and guidelines laid down by Occupational Safety and Health Administration and Centers for Disease Control and Prevention.⁴ The teeth were then placed in 0.9% physiologic saline solution for ten days prior to access cavity preparation. The samples were divided into three experimental groups; Group I: Sealapex, Group II: Tubliseal and Group III: AH26 with 12 samples in each group.

Standard access cavity and biomechanical preparation with step back flare technique were done. Obturations were done using respective sealers in the three different groups. The samples were then coated with nail varnish all over the root surface except 2 mm around the apical foramen. 2 ml of freshly prepared 2% methylene blue dye was taken in each vial and

the apical third of the root was suspended in the dye for 72 h. Samples were washed with distilled water, nail varnish removed and then placed in 20 ml of 35% nitric acid for 72 h. Standard solutions of 1%, 0.5%, 0.2%, 0.05%, 0.02% and 0.01% of methylene blue in 35% nitric acid were prepared and stored for 72 h. The Standard solutions and the nitric acid solutions were filtered and centrifuged for 1 min after 72 h. The supernatant was subjected to spectrophotometric analysis using a filter of 670 nm. The amount of leakage was extrapolated from a standard linear regression curve constructed from stock standard methylene blue dye solutions. Obtained data were statistical analyzed with Kruskal–Wallis and Mann–Whitney U-tests using SPSS Software Version 20 (IBM).

Results

The results of the quantitative evaluation of the sealing properties of the three root-canal sealers are shown in Table 1. Table 2 and Chart 1 show intra group comparison of micro leakage of sealers. Tubliseal exhibited the least microleakage (Table 1). In comparison to Sealapex, Tubliseal showed a significant difference ($P > 0.005$). In comparison to Sealapex, AH26 showed no significant difference. Comparisons made between Tubliseal and AH26 showed no significant difference (Table 2, Chart 1).

Discussion

Three-dimensional obturation of the root canal system with a fluid impervious seal is an important factor for successful endodontic therapy. The root canal filling should seal the canal both apically and coronally to prevent the passage of microorganism to apex or *vice versa*.⁵ Most reliable method is the use of gutta-percha cones with sealer cement. A wide variety of root canal sealers is available commercially. Sealers based on zinc oxide-eugenol (Tubliseal), calcium hydroxide (Sealapex), epoxy resins (AH26) were included in the present study.

In present quantitative dye leakage study, Tubliseal demonstrated least dye leakage in comparison with other experimental groups (Table 1). There was a significant difference between Sealapex and Tubliseal (Table 2). Our results were in contrary to study by Masoud and Saleh where they found more microleakage in Tubliseal group than other groups.⁶

Sealapex is a calcium hydroxide type sealer. Calcium hydroxide used as root canal sealer since it stimulates periapical tissues in order to maintain health or promote healing and secondly for its antimicrobial effects.⁷ It has been observed in some studies that, calcium hydroxide sealers showed a significant volumetric expansion during setting because of water absorption, which increases its solubility. The present *in vitro* investigation indicated maximum leakage value with Sealapex among the experimental groups. In a contradictory to our results, Cobankara *et al.* (2006) observed Sealapex with better apical sealing than the other sealers (AH plus and RC sealer) at 7, 14, and 21 days.³

AH26 is an epoxy resin based sealer that provides easy handling characteristics, good flow, good sealing to dentin and prominent antimicrobial activity.⁶ Kumar *et al.* observed more micro leakage with zinc oxide-based sealer and least with resin based sealers, this is contradictory to our study.⁸ In our study, there was no statistical significant difference between Tubliseal and AH26 in micro leakage. Gernhardt *et al.* observed least amount of dye penetration for AH Plus and EndoRez group.⁹

Table 1: Mean and standard deviation values of volumetric dye penetration in groups with reference to transmission.

Group	Transmission (%)	
	Mean	Standard deviation
I	50.25	19.397
II	66.5	7.969
III	57.33	8.937

Kruskal-Wallis test results

Transmission	H=5.66	P>0.05	Not significant
--------------	--------	--------	-----------------

Group I: Sealapex, Group II: Tubliseal, Group: III-AH26

Table 2: Inter group comparison for dye penetration.

Group	Transmission		
	Value of significance	Significance	
I versus II	Z=2.083	P<0.05	Significant
I versus III	Z=1.44	P>0.05	Not significant
II versus III	Z=1.28	P>0.05	Not significant

Group I: Sealapex, Group II: Tubliseal, Group III: AH26, Mann-Whitney U-test results of different groups when compared with each other

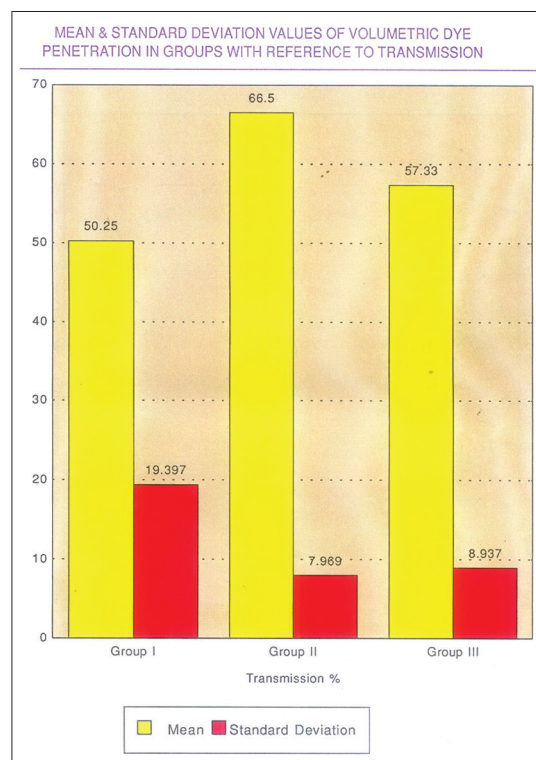


Chart 1: Inter group comparison chart for dye penetration of different sealers.

Even though, the current study did not indicate any statistically significant difference between AH26 and Sealapex, it is time to question the overall efficacy of calcium hydroxide sealers on the grounds that the reparative and the calcification capabilities attributed to calcium hydroxide are generally desirable before completing the obturation. AH26, resin based sealer provided a better apical seal when compared with Sealapex even though the results were statistically not significant. AH26 appears to have many advantages over other sealers. It mixes easily, flows well, and has ample working time, good radio-opacity, comparable solubility, good adhesion and good biocompatibility.³

In the present study, there was no significant difference between Group II and III and Group I and III. This is in agreement with De Almeida *et al.*¹⁰ Silva *et al.* didn't find any significant difference between the tested three groups; sealer 26, Endoflas and resin group. But they observed higher microleakage in sealer 26 group compared with control.¹¹ Joseph and Singh evaluated the apical sealing with four root canal sealers; AH26, Sealapex, Endoflas FS and AH Plus and observed no significant differences between all groups except between AH Plus and Endoflas.⁵ Nagas *et al.* observed significantly lower overall leakage with AH plus group, whereas no difference was found between master cone points.¹² Kopper *et al.* observed significant dye penetration for AH Plus, Endofill and Sealer 26.¹³

Cobankara *et al.* observed better sealing values for RoekoSeal after 21 days when compared to Ketac-Endo and AH Plus, and there was no statistically significant difference.¹ Dultra *et al.* found no statistical difference between groups for apical leakage (Endofill, AH Plus, EndoRez and EpiPhany).¹⁴

In addition, before accepting a new material for routine clinical use further experiments should also be performed to evaluate the other aspects of the materials' physical and biological properties such as biocompatibility, solubility, disintegration, radio-opacity and dimensional stability. However, these *in vitro* studies do provide comparative information of the relative performance of sealers tested under the same conditions in each particular study and clinicians can use this information to possibly choose a better sealer.

Conclusion

In the present study, Tubliseal sealer showed least microleakage compared with Sealapex and AH26 sealer. However, there was a significant difference between Sealapex and AH26 groups. It is important to remember before declaring any root canal sealer as most acceptable that the results of the dye penetration

studies indicate only the relative sealing ability of root canal fillings *in vitro* and they do not indicate their ability to prevent the penetration of bacteria into filled root canals *in vivo*.

References

1. Cobankara FK, Adanir N, Belli S, Pashley DH. A quantitative evaluation of apical leakage of four root-canal sealers. *Int Endod J* 2002;35(12):979-84.
2. Verissimo DM, do Vale MS. Methodologies for assessment of apical and coronal leakage of endodontic filling materials: A critical review. *J Oral Sci* 2006;48(3):93-8.
3. Cobankara FK, Orucoglu H, Sengun A, Belli S. The quantitative evaluation of apical sealing of four endodontic sealers. *J Endod* 2006;32(1):66-8.
4. Dickinson SK, Bebermeyer RD. Guidelines for infection control in dental health care settings. Crest® Oral-B® at Continuing Education Course. p. 1-34. Available from: <http://www.dentalcare.com>. [Last Revised on 2013 Jul 19].
5. Joseph R, Singh S. Evaluation of apical sealing ability of four different sealers using centrifuging dye penetration method: An *in vitro* study. *J Contemp Dent Pract* 2012;13(6):830-3.
6. Masoud MH, Saleh KA. Assessment of apical leakage of different endodontic sealers using a new method – An *in vitro* study. *J Dent* 2012;2(4):264-8.
7. Desai S, Chandler N. Calcium hydroxide-based root canal sealers: A review. *J Endod* 2009;35(4):475-80.
8. Kumar RV, Shruthi C. Evaluation of the sealing ability of resin cement used as a root canal sealer: An *in vitro* study. *J Conserv Dent* 2012;15(3):274-7.
9. Gernhardt CR, Krüger T, Bekes K, Schaller HG. Apical sealing ability of 2 epoxy resin-based sealers used with root canal obturation techniques based on warm gutta-percha compared to cold lateral condensation. *Quintessence Int* 2007;38(3):229-34.
10. De Almeida WA, Leonardo MR, Tanomaru Filho M, Silva LA. Evaluation of apical sealing of three endodontic sealers. *Int Endod J* 2000;33(1):25-7.
11. Silva G, da Silva EJ, da Silva JM, Andrade-Júnior CV, Randi Ferraz CC. Sealing ability promoted by three different endodontic sealers. *Iran Endod J* 2011;6(2):86-9.
12. Nagas E, Altundasar E, Serper A. The effect of master point taper on bond strength and apical sealing ability of different root canal sealers. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;107(1):e61-4.
13. Kopper PM, Figueiredo JA, Della Bona A, Vanni JR, Bier CA, Bopp S. Comparative *in vivo* analysis of the sealing ability of three endodontic sealers in post-prepared root canals. *Int Endod J* 2003;36(12):857-63.
14. Dultra F, Barroso JM, Carrasco LD, Capelli A, Guerisoli DM, Pécora JD. Evaluation of apical microleakage of teeth sealed with four different root canal sealers. *J Appl Oral Sci* 2006;14(5):341-5.