

**How to Cite:**

Vanapatla, A., Tulasi, P. N., Neethu, N. B., Sneha, P., Avinash, M., & Tiwari, H. D. (2022). Comparison of apical leakage between immediate versus delayed post space preparation using various root canal sealers: An invitro study. *International Journal of Health Sciences*, 6(S1), 11800–11806. <https://doi.org/10.53730/ijhs.v6nS1.7881>

# **Comparision of apical leakage between immediate versus delayed post space preparation using various root canal sealers: An invitro study**

**Dr. Amulya Vanapatla**

Asst. Professor, Dept of conservative Dentistry and Endodontics, Government Dental College and Hospital, Hyderabad.

Email: [doctor.amulya.mds@gmail.com](mailto:doctor.amulya.mds@gmail.com)

**Dr. Tulasi Priya. N**

Asst. Professor, Dept of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Hyderabad.

Corresponding Author email: [vennelan591@gmail.com](mailto:vennelan591@gmail.com)

**Dr. Neethu Nanda. B**

Senior Resident, Dept of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Hyderabad.

Email: [neetunanda24@gmail.com](mailto:neetunanda24@gmail.com)

**Dr. P. Sneha**

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

Email: [pallepagusneha@gmail.com](mailto:pallepagusneha@gmail.com)

**Dr. M. Avinash**

Consultant Oral and Maxillofacial Surgeon, Magnum Dental Clinic, Manikonda, Hyderabad.

Email: [avinashmuthyampally@gmail.com](mailto:avinashmuthyampally@gmail.com)

**Dr. Heena Dixit Tiwari**

BDS, PGDHHM, Final year Student, Master of Public Health, Parul Univeristy, Limda, Waghodia, Vadodara, Gujrat, India.

Email: [drheenatiwari@gmail.com](mailto:drheenatiwari@gmail.com)

**Abstract**---Aim of the study: The present study evaluated the apical leakage of endodontic sealers after immediate and delayed post space preparation. Methodology: Sixty-six extracted human maxillary incisors with straight root and single canals were selected and

decoronated. They were divided into five groups and obturated using three different sealers (AH Plus sealer, Apexit Plus sealer, Bioceramic sealer) respectively. Specimens were longitudinally sectioned and were observed under stereomicroscope. Results were analyzed and tabulated. Results: There was a statistically significant difference between the immediate and delayed post space preparation. Immediate post space preparation showed less leakage compare to delayed post space preparation. Conclusion: Bioceramic Sealer showed the least leakage at different intervals of post space preparation followed by AH Plus sealer. Apexit Plus showed more leakage among the groups at different intervals..

**Keywords**---Endodontic sealers, apical leakage, post space preparation.

## **Introduction**

The hermetic seal of the root canal and coronal parts is one of the objectives of the root canal therapy.<sup>1</sup> An ideal root canal sealer should have low viscosity and good wetting properties to flow easily into the dentinal irregularities, accessory canals and multiple apical foramina and to fill the space between gutta-percha cones and surface of the root canal.<sup>2,3</sup>

The most common cause of failure involving endodontic therapy can be attributed to the lack of an apical seal leading to leakage at the apex.<sup>4</sup> Apical seal is influenced by many variables such as different filling techniques, the physical and chemical properties of sealers and the presence or absence of a smear layer.<sup>5</sup> The root canal sealers are used with the semisolid or solid core filling material to provide the required adhesion to canal walls, the cementation of the obturating materials to itself, to fill voids and spaces between the obturating material and the tooth structure to form a fluid tight seal.<sup>4</sup> Due to the caries and access cavity preparation, endodontically treated teeth sometimes need to be restored with post core and crown restoration. The first step in making post and core is the removal of a portion of the gutta-percha from the root canal space.<sup>6</sup> The effect of post space preparation on the sealing ability of a root canal filling had been evaluated and discussed widely in dental literatures. Gutta-percha removal techniques, immediate or delayed preparation, amount of remaining root canal filling, type of sealer and obturation techniques used have been the subject of these investigations concerning post space preparation. During the post space preparation, it is important not to disrupt the integrity of the apical seal.<sup>7,8</sup> Metzger et al. demonstrated the sealing to be proportional to the length of the remaining root canal filling.<sup>16</sup> Five millimetres of obturation material is considered as a safe margin. In many clinical situations, however, a smaller remnant has to be left in order to increase the post retention, there by compromising the apical seal. Although some authors considered 3mm as the minimum acceptable remnant to, preserve the seal. Abramovitz et al. reported that a reduction of filling to 3mm produced an unpredictable seal. In these situations, the sealer becomes crucial for preserving the apical seal.<sup>9,10</sup> The success of endodontic treatment requires canal obturation materials to have good

sealing ability. In addition, the techniques used during and after obturation must not impair these materials ability to preserve the apical and coronal seal.<sup>11</sup> Although several obturating materials are available, studies have shown that none of them are able to avoid apical leakage completely.<sup>12</sup>

### **Aim of the study**

The purpose of this study is to evaluate the apical sealing ability of three different root canal sealers after immediate and delayed post space preparation of AH Plus, Apexit Plus and Bioceramic sealer using dye penetration method.

### **Methodology**

Freshly extracted sixty-six non carious human permanent maxillary incisors with straight and single patent canal were selected. Inclusion criteria: Intact, freshly extracted maxillary incisors with straight single patent canal with completely formed apices. Exclusion criteria:

- Teeth with caries involving the root
- Teeth which have undergone attrition or abrasion and have been restored and with surface cracks/defects
- Teeth with bifurcated canals
- Teeth with extreme calcification
- Incompletely formed apex
- Curved canals

Conventional access cavity preparation was done using Endo Access diamond point. Working length was established using 15# K file, 1mm short of length where the file exited the apical foramen. The teeth were instrumented with ProTaper up to F3. Teeth were then randomly divided in to five groups.

GROUP I: Specimens obturated with AH Plus (Dentsply, Konstanz, Germany) sealer (n=20)

GROUP II: Specimens obturated with Apexit Plus (Ivoclar Vivadent) sealer (n=20)

GROUP III: Specimens obturated with Endosequence bioceramic sealer (Brasseler, Savannah, GA, USA) (n=20)

GROUP IV: Positive Control – Specimens were obturated without sealer (n=3)

GROUP V: Negative Control – Specimens were instrumented but not obturated (n=3).

All the groups were further sub-divided into two sub-groups:

Sub-Group A: Immediate post space preparation (n=10) using Hand pluggers and Peeso reamers at 9000 rpm to a depth of 5mm apically.

Sub-Group B: Delayed post space preparation (n=10) in which the teeth were obturated and placed in saline at 37°C until the sealer sets and post space was made in the same manner as in the immediate post space preparation group.

Teeth were then immersed in 2% methylene blue dye for 48 hrs. After removal from the dye, the specimens were washed and dried. All the samples were then grooved longitudinally in bucco-lingual direction. Teeth were then imaged using stereomicroscope and were observed for dye penetration. The amount of apical dye migration was measured by using measuring ruler in Photo shop 7.0 and image J software analysis. The values obtained were tabulated and subjected for

statistical analysis. The data were statistically analyzed using Paired T-Test, ANOVA and Post Hoc tests using SPSS version 14.

## Results

Immediate post space preparation groups showed least amount of apical leakage compared to delayed groups. (Table 1) Immediate post space preparation groups of AH Plus, Apexit Plus and Bioceramic sealer showed a statistically highly significant difference with Delayed post space preparation groups of AH Plus, Apexit Plus and Bioceramic sealer i.e.  $P=0.000$ . AH Plus showed least amount of apical leakage compared to Apexit Plus in both sub-groups A & B. In delayed post space preparation groups, the difference between AH Plus and Bioceramic sealer showed no statistically significant difference (0.457,  $p$  value 0.517). Bioceramic sealer showed least amount of apical leakage compared to Apexit Plus in both sub-groups A & B. (Graph1)

## Discussion

An endodontically treated tooth that has lost significant tooth structure may require a post and core for restorative rehabilitation. But the retreatment of this procedure is extremely difficult and cumbersome. Any failure caused by apical leakage will result into a re-infected tooth making the entire procedure come to a zilch. Therefore, it is deemed necessary to evaluate the sealing ability of the obturating material especially in the apical portion before making it a material of choice.<sup>13</sup> Immediate post space preparation by the same operator, who has just finished obturating the canal, can be done under rubber dam, using the same aseptic conditions and additional advantage of this protocol is that the condensation of the remaining gutta-percha can be assessed and improved if necessary. Finally, the familiarity of the operator with the root canal system minimizes the risk of perforation or stripping.<sup>14</sup> Yet the common procedure is late removal of the coronal part of the root canal filling performed at a regular visit.<sup>15,16</sup> The procedure is usually performed using rotary instruments such as gates glidden drills, peeso reamers with or without a gutta-percha solvent. Microleakage studies such as dye penetration was chosen in the study as it is an easy and fast method that are common to gauge microleakage of root canal fillings. The other microleakage studies are fluid transport, pressurized fluid filtration, radioactive isotope, and bacterial leakage. Longitudinal sectioning was chosen in the study as it is the most widely used methodology for assessing dye leakage is the longitudinal sectioning of samples, expressing the measurement in linear millimeters. The advantage of this technique for our study was that we were able to measure the dye, and the total leakage of a dye could be counted from a single section.<sup>17</sup> Methylene blue dye is chosen in the present study because of its very small molecular size that shows a deeper penetration than the commonly used radioisotopes. Barros J et al., evaluated the integrity of the apical seal in root filled teeth following immediate post space preparation and after eight days obturated with Sealapex® sealer (Kerr-Sybron, Scafati, Italy). The timing of post space preparation, in teeth filled with Sealapex® sealer (Kerr-Sybron, Scafati, Italy), did not affect the apical sealing ability.<sup>18</sup> Setia P, compared the sealing ability of two root canal sealers viz.: Hybrid Root SEAL(Sun Medical, Tokyo, Japan) and iRoot SP (Innovative BioCeramix Inc., Vancouver, Canada). There was

no statistically significant difference among the two groups.<sup>19</sup> Miletic, Anic, S. Pezel-Ribaric, S. Jukic et al., in their study<sup>20</sup> of leakage of five root canal sealers examine the apical sealing ability of five root canal sealers AH Plus, AH 26, Diaket, Apexit, Ketac Endo using a fluid transport model found Apexit showed more dye penetration than AH Plus which also supports the present study. The present study compares the apical seal in immediately and after the sealer sets (delayed) post space preparation. If the same study was conducted at 6 months or 1year intervals difference in the results may occur. According to Seltzer et al only limited information of clinical significance can be obtained from vitro studies of the sealing properties of root canal sealers.

### **Conclusion**

Study reveals that there was a statistically significant difference between the sealers, when the post space was made at different time intervals. Immediate post space preparation showed less leakage compare to delayed post space preparation. Bioceramic sealer showed the least leakage at different intervals of post space preparation followed by AH Plus sealer. Apexit Plus showed more leakage among the groups at different intervals.

### **References**

1. Prado CJ, Estrela C, Panzeri H, Biffi JCG. Permeability of remaining endodontic obturation after post preparation. *General Dentistry* 2006; 41-43.
2. De Gee AJ, Wu MK, Wesselink PR. Sealing properties of Ketac Endo Glass Ionomer Cement and AH 26 Root. *Int Endod J.* 1994; 27:23944.
3. Cobankara FK, Adanir N, Belli S, Pashley. A quantitative evaluation of apical leakage of four root canal sealers. *Int Endod J.* 2002 Dec;35(12):979-84.
4. Goldberg F, Massone EJ and Artaza LP. Comparision of the sealing capacity of three endodontic filling techques. *J Endod* 1995;21:1-3.
5. Verissimo DM and Sampaio do Vale M. Methodologies for assessment of apical and coronal leakage of endodontic filling materials: a critical review. *J of Oral Science* 2006; 48: 93-98.
6. Haddix JE, Mattison GD, Shuman CA and Pink FE. Post preparation techniques and their effect on the apical seal. *J Prosthet Dent* 1990;5: 515-519.
7. Abramovitz I, Tagger M, Tamse A. The effect of immediate vs delayed post space preparation on the apical seal of a root canal filling: a study in an increased sensitivity pressure-driven system. *J Endod* 2000;26:435-439.
8. Hauman CH, Chandler NP, Purton DG. Factors influencing the removal of the posts. *Int Endod J* 2003;36:687-690.
9. Haddix JE, Mattison GD, Shulman CA, Pink FE. Post preparation techniques and their effect on apical seal. *J Prosthet Dent* 1990;64:515-519.
10. Cohen S, Burns RC. *Pathways of the pulp.* 7th ed. 1998 St. Louis: Mosby.
11. Madison S, Zakariasen K. Linear and volumetric analysis of apical leakage in teeth prepared for posts. *J Endod* 1984;10:422-427.
12. Almedia WA, Leonardo MR, Filho MT & Silva LAB. Evaluation of apical sealing of three endodontic sealers. *Int Endod J* 2000;33:25-27.
13. Dhaded N, Uppin VM, Dhaded S, Patil C. Evaluation of immediate and delayed post space preparation on sealing ability of Resilon–Epiphany and

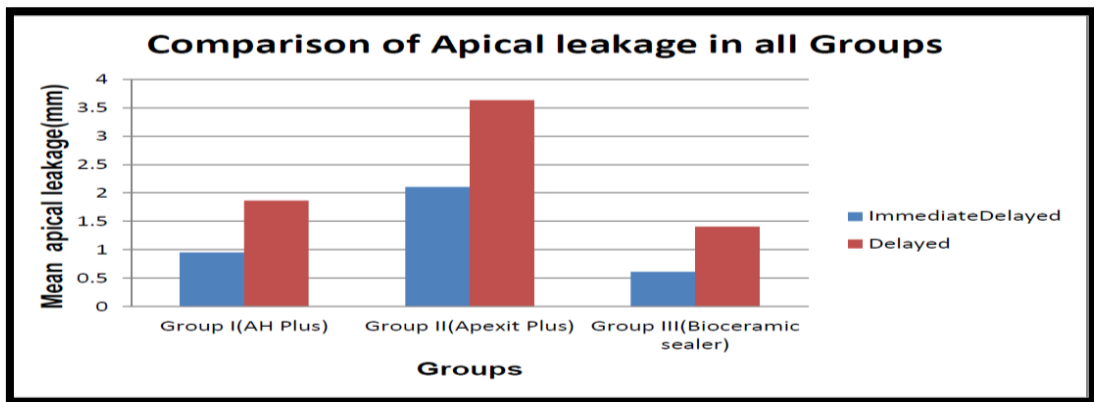
- Gutta percha-AH plus sealer. *Journal of Conservative Dentistry* Nov-Dec 2013;16(6).
14. Aydemir H, Ceylan G, Tasdemir T, Kalyoncuoglu E, Isildak I. Effect of immediate and delayed post space preparation on the apical seal of root canals obturated with different sealers and techniques. *J.Appl.Oral Sci.* vol.17 no.6 Bauru Nov.Dec. 2009.
  15. Serafino C, Gallina G, Cumbo E, Ferrari M. Surface debris of canal walls after post space preparation in endodontically treated teeth: a scanning electron microscopic study. *Oral Surg Oral Med Oral Pathol, Oral Radiol Endod* 2004;97:381-387.
  16. Metzger Z, Abramovitz R, Abramovitz L, Tagger M. Correlation between remaining length of root canal fillings after post space preparation and coronal leakage. *J Endod* 2000;26:724-728.
  17. Roggendorf MJ, Ebert J, Petschelt A and Frankenberger R. Influence of moisture on the apical seal of root canal fillings with five different types of sealer. *J Endod* 2007;33:31-33.
  18. Barros JD, Cruz J, Carvalho MF, Pinavaz I. Influence of the timing of post space preparation on apical sealing. *RGO - Rev Gaucha Odontol., Porto Alegre*, v.61, n.2, p. 199-204, abr./jun 2013.
  19. Setia P, Sikri VK, Sroa RB. Apical sealing ability of two novel root canal sealers: an ex-vivo study. *Journal of the international clinical dental research organization* january-december 2013;5(1).
  20. Miletic I, Anic I, Ribaric SP and Jukic S. Leakage of five root canal sealers. *Int Endod J* 1999;32:415-418.

**TABLES**

Table 1  
Multiple comparisons of apical leakage of all sealers with immediate and delayed post preparation groups

Comparison	Immediate		Delayed	
	Mean Difference	P value	Mean Difference	P value
Group I vs II	1.153	<0.001	1.770	0.001
Group I vs III	0.341	0.355	0.457	
Group II vs III	1.494	<0.001	2.227	<0.001

\*p < 0.05= Significant



Graph 1- Representing the apical leakage of all groups